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EDITED BY

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Journal of the Royal Army Medical Corps.

Original Communications.

APPRECIATIONS BY OFFICERS OF THE MEDICAL SERVICES.

By COLONEL E. P. SEWELL, C.M.G., D.S.O.

THE controversy on the correct method of writing a "Medical Appreciation" still rages, and the bewilderment of candidates for promotion increases with each divergent view which they bear or read.

The protagonists may be divided roughly into two parties—one which advocates a full, comprehensive and detailed examination of the whole situation from front to rear, and another which pictures a harassed general sitting in a tent snowed under by the appreciations of his whole staff and trying to read them by the light of a single guttering candle, while he hurls anathemas at the head of a conscientious but prolix A.D.M.S.

Now, in the first place, is not this divergence of opinion the result of a want of clear thinking? Are not the two parties to the dispute visualizing different conditions? Training and Manœuvre Regulations 1923, Sect. 25, para. 2, distinguishes between: "(1) Appreciations in connexion with subjects elaborated in peace time, such as plans of campaign; and (2) appreciations of minor strategy or tactical problems in the field which, in the case of minor tactical problems, may not even be committed to paper."

Appreciations written by officers of the Medical Services should also be classified in the same manner. In Class (1) I would include not only the appreciations which are made in peace time, but also those made at the outset of a campaign, or at the outset of a new phase of a campaign, by the Administrative Medical Officer responsible for the provision of medical units and equipment, and for the medical policy of the campaign. This

officer is generally the Director of Medical Services of the Force. Under certain circumstances it may conceivably be the Deputy Director of Medical Services of a smaller force located in some area remote from the main operations of the war, e.g., East Africa in the Great War. I cannot conceive, however, of any circumstances in which an A.D.M.S. is the officer responsible for the medical arrangement of a campaign from front to base.

In Class (2) would be the appreciations of A.D's.M.S. of Divisions.

Training and Manœuvre Regulations state definitely that Class (1) appreciations (i.e., those written by a D.M.S. for the information of the commander of an independent force) should be full and should enter into every known and surmised factor, however slightly it may bear on the situation. For medical appreciations, that means all factors which have a bearing on the health of the troops, the number of casualties and the resulting requirements of medical units, and medical and sanitary supplies.

As regards Class (2) appreciations (i.e., those written by the A.D.M.S. for the information of the Divisional Commander), it is stated that "rapidity is generally all-important, and the time available will seldom admit of all the factors being recorded, though they should all receive consideration."

Let us consider briefly what the G.O.C. of a division wants to hear from his A.D.M.S. Here the affecting picture of the overworked general trying to read a number of appreciations by the light of a guttering candle may be a true one, and I cannot imagine him wading through a lengthy medical appreciation such as that set forth by a "Staff Officer" in the ROYAL ARMY MEDICAL CORPS JOURNAL of August, 1927. Moreover, as that appreciation is supposed to be written by the A.D.M.S. of a force consisting of a division and a cavalry brigade, that officer would not be in a position to discuss the resources available for evacuation of casualties from his divisional area. The supply and control of medical units behind his divisional area would not be in his hands.

If the A.D.M.S. of a division were ever asked for an appreciation, which I think is unlikely, I imagine the G.O.C. would desire to be told :—

(1) Whether there were any special factors such as climate or prevalent diseases which would be likely to affect the health of the troops, and what steps were recommended to minimize any such dangers.

(2) Any *special* points in connexion with food and water supplies which might affect the health of the troops, and recommendations in that connexion.

(3) The disposition of the divisional medical units and the position of C.C.S.'s to which evacuation has been arranged by higher authority.

These, I think, are the only points concerning which the G.O.C. of a division would require information from his A.D.M.S., and an appreciation should be framed on these lines and should be as brief and concise as possible.

We come now to a consideration of the more elaborate appreciations written by a D.M.S. (or D.D.M.S.) at or before the beginning of a campaign or at the outset of a new phase of a campaign; and, before going any further, let us once more study our Training and Manœuvre Regulations as amended by Army Order No. 117 of 1926, which say, "The writing of appreciations in the accepted logical sequence is a necessity. The general headings and the necessary sequences are: (1) Object; (2) considerations which affect the attainment of this object; (3) courses open to the two sides; (4) plan. Unless the object is clearly stated in the opening paragraph, the appreciation is apt to become involved and the decision—which is the aim and object of all appreciations—shrouded in doubt." It is evident that these headings, especially (3), are not very suitable for medical appreciations, but they will serve as a guide. So first let us endeavour to reason logically and then try to find a suitable form to convey the results of our reasoning to others, whether they be superior medical officers or staff officers not perfectly acquainted with the functions of our Service.

Our object then, what is it? Obviously it is to assist the Army Commander to gain his objective both by using our special knowledge to keep his men fit and also by removing his casualties caused by sickness and wounds which would otherwise hamper his movements.

How can we attain that object? By foreseeing epidemics of disease, and forestalling them by proper measures of prevention; by minimizing the daily wastage of men by adequate arrangements as regards food, drink, shelter, clothing, washing, disinfection, sanitation, and so on.

Also by ensuring the rapid removal of casualties by the proper provision and disposition of medical units and medical supplies.

What are the considerations which affect the attainment of our object? These are:—

(*a*) *Topographical.*—It is evident that both the prevention of disease and the method of removal of casualties will vary enormously, according to whether the force is wallowing in mud or operating on dry uplands or in mountains. The presence or absence of roads, railways, canals, &c., affects removal.

(*b*) *Climate.*—Similarly, there is an enormous difference between the wet and cold of Flanders and a campaign in the heat and drought of the Sinai Peninsula.

(*c*) *Prevalent Diseases.*—These will vary according to whether the campaign is in the tropics or in a temperate climate, in the plains or in the hills, in a dry or well watered land, and so on; and also according to the time of year in temperate and subtropical climates.

(*d*) Supplies of food and water.

(*e*) The number and nature of the casualties, which will vary according to the amount of sickness which occurs and to the equipment of the enemy with such weapons as modern artillery, tanks, gas and air-craft.

(*f*) The position and mobility of field medical units.

(*g*) The position and capacity of hospitals on the L. of C. at the base and in the home country, the number of beds in each area and the means available for evacuation, e.g., hospital trains, canal boats, motor ambulances and hospital ships.

The next heading laid down in the Training and Manœuvre Regulations is "Courses Open to both Sides." This heading is not quite suitable for a medical appreciation, unless we regard disease as the enemy. In this case it would be a good place in which to discuss the probable effect of occupying a locality which for one reason or another is likely to cause an increased wastage of men by disease.

For instance, if it had been possible to inform the Army Commander of the probable loss of men by malaria on the occupation of the Struma Valley, he might have considered that the military advantages of the occupation were not sufficient to counterbalance the loss of man-power. Another instance was the occupation of the Auja Valley, in Palestine. In this case the Corps Commander was told to what extent malaria was likely to waste his man-power, and what help might be expected from anti-malaria measures. After very careful consideration he decided that the military necessity was paramount, and that the cost must be paid.

The Army Commander has a right to expect a fair and reasoned statement of the probable cost of any course he may contemplate, and his medical adviser should give it him as clearly and as accurately as may be possible.

This heading might be changed to "the effect of any particular course on the wastage of men from disease," and under it anything which is likely to cause a large increase of sickness should be discussed.

Having considered our object, the means of attaining it and the considerations which affect its attainment, we come logically to our *plan*, which may be divided into two parts: (*a*) The prevention of disease, and (*b*) the collection, evacuation and distribution of casualties.

Under (*a*) it is obviously impossible to give in detail "all sanitary and hygienic measures to be taken to preserve health," as stated by "Staff Officer" in the above-quoted paper. One might as well attach a copy of the "Manual of Military Hygiene." Personally, I think it sufficient to state the *special* dangers of the campaign and the *special* precautions necessary to meet them. One might say, for example, "The country is highly malarious in the months of July, August and September, especially the X Valley, which should be avoided if possible during these months. Mosquito nets will be required by all troops, and huts at base and on the L. of C. should be made mosquito-proof. Detailed recommendation will be issued later."

Or again, "Cholera is rife in the locality of Y. All troops should be inoculated against the disease before leaving their stations (or before entering the locality), and special hospital provision for cholera cases will be necessary."

Such remarks as these would attract the attention of the responsible officer when reading the appreciation, and he would, if he felt it necessary, ask for further details which would be elaborated by the A.D.H. of the force; but a lengthy dissertation on field sanitation and hygiene in general would defeat its own object.

Under (*b*) the D.M.S. would give: (1) His estimate of battle casualties; (2) his estimate of sick wastage; (3) his estimate of the hospital accommodation required; (4) his arrangements for supplying the accommodation; (5) the distribution of his field medical units during the period of concentration and during the first phase of the campaign, if he can forecast it; (6) the method of evacuation he proposes to employ, including a statement of what roads, railways, canals, etc., he wishes to use. This is of the utmost importance to enable the Staff to make their time-tables and arrangements for traffic control.

All calculations and technical matter should be given in an appendix, and only the results embodied in the appreciation.

CONCLUSIONS.

(*a*) Distinction should be made between appreciations elaborated by a D.M.S. (or possibly D.D.M.S.) before the beginning of a campaign, or of a new phase of a campaign, and those written by the A.D.M.S. of a division in connexion with minor strategical or tactical problems in the field. The former should be comprehensive, the latter concise.

(*b*) A comprehensive appreciation should follow the principles and, as far as possible, the forms laid down in Training and Manœuvre Regulations. The headings should be:—

(1) *Object.*—This may be stated as: "To assist the Army Commander in the attainment of his objective by maintaining the health of the troops; and by the speedy removal of casualties from the field of operations, and their evacuation to the base and home territory for appropriate treatment.

(2) *Considerations which Affect the Attainment of this Object.*—Under this head all factors special to the campaign which affect the health of the troops should be discussed under subheads topography, climate, prevalent diseases, supplies of food and water. This should be followed by an examination into the various medical units, hospitals, means of transport, etc., available.

(3) *The Effect of any Particular Course on the Wastage of men from Disease.*—There may be nothing to add under this heading, but if there is some special and paramount danger to the troops, it should be discussed here in moderate but decisive language.

(4) *The Plan.*—Under this heading should be given: (*a*) Recommendations for the prevention of disease. These should be confined to special measures required by the situation. (*b*) A scheme for the collection, evacuation, and distribution of casualties from sickness and wounds, following an estimate of the number of casualties under each head.

REPORT ON AN INVESTIGATION OF DYSENTERY AND DIARRHŒA IN POONA[1].

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ASSISTED BY

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Indian Medical Department.

(*Continued from p.* 426.)

PART II.

LABORATORY FINDINGS.

I. BACTERIOLOGICAL EXAMINATIONS.

Blood and mucus from 190 bacillary cases in 1925, and from 300 up to the end of September, 1926, were examined in the district laboratory.

These figures refer only to cases among the troops in Poona and Kirkee, and are exclusive of specimens sent in from outstations.

Technique.

The routine carried out was that a portion of mucus was picked up on a platinum loop, rinsed gently in sterile saline, and then streaked across a bile salt litmus lactose agar plate by means of the platinum loop.

At the same time another specimen of mucus was placed on a slide, flattened out under a coverslip and examined with the one-sixth lens.

It is important that only a small portion of mucus be taken for this examination in order that as thin a specimen as possible be examined. The result of microscopic examination was then sent to the medical officer in charge "*by the bearer of specimen*," stating either that a bacillary exudate was present, *E. histolytica* present, or that no definite opinion could be given. This advance report was found very useful from a treatment point of view.

The time at which the stool was passed, and of its plating out, plus the reaction of the mucus and the macroscopic and microscopic appearance were entered in a special register.

Litmus lactose bile salt medium was found much the easiest to work with, once good litmus granules were obtained.

A *dry* plate is of course absolutely essential. Plating out on a wet plate is merely a waste of time.

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[1] Reprinted by kind permission from the *Indian Journal of Medical Research*, vol. xv, No. 3, January, 1928.

On the next day likely colonies were picked off, if possible five from each plate, and inoculated direct into glucose and mannite peptone salt solution, plus Andrade's indicator. After twenty-four hours' incubation of these sugars, it was possible to run through the series of tubes quickly, and discard any organisms not fermenting either glucose and mannite, or glucose only, without gas. This method saved a great deal of time, and in practice was very effective. Colonies giving the reactions of Flexner group, or of *B. shiga*, were then dealt with by subculturing from the glucose tube into lactose, dulcite, peptone salt and broth. The lactose tube, if the sugar was not fermented in twenty-four hours, was kept in the incubator for three weeks to ascertain if the strain was a late lactose fermenter. The peptone salt culture was tested for indol by Dr. Gore's technique using Bohme's solutions. The broth culture was first examined by the hanging drop method for motility, and then formalinized by the addition of formalin to 0·1 per cent and kept for serological tests.

Teague and Clurman's glycerine and saline solution was found to be very efficient when specimens had to be sent from outstations, and *B. flexner* was isolated frequently in specimens sent from Aurangabad, Belgaum and Ahmednagar by train. Dried films of mucus from outstations were also found useful as a means of diagnosing the bacillary exudate. We found the best stains for these to be hæmatoxylin, and Biebrich's scarlet as a counter stain, after fixation in methyl alcohol. As a matter of fact if a reasonably large sample of mucus was placed in the glycerine and saline solution and not emulsified too thoroughly, this solution preserved the cells wonderfully well. In cases of suspected amœbic dysentery cover-slips from outstations sent in seventy per cent alcohol after fixation in Schaudinn's solution were examined after staining by Heidenhain's iron-hæmatoxylin (long method).

Macroscopic appearances of the stools were in the main as described by Acton, Knowles and other authors. In the mild Flexner cases, particularly among Indian troops, the mucus was often in very small amounts and was frequently missed by the hospital subordinate whose duty it was to select the sample for transmission to the laboratory. In bacillary cases it was invariably neutral or alkaline to litmus paper.

Microscopic appearances appeared to us more important than the macroscopic, and the diagnostic value of the cellular exudate simply cannot be overstated. In acute cases two seconds' examination after a little experience is sufficient for diagnostic purposes.

In the very mild Flexner cases, however, careful search was often necessary to find the small collections of polymorphonuclear leucocytes among the debris of the loose stool. Had we been able to select the sample for examination ourselves from the entire stool there would probably have been less difficulty. Such specimens were often reported upon as indefinite but suggestive of bacillary dysentery.

The results of bacteriological examinations of these cases have already

been given, and the results of serological tests on the patient are discussed later.

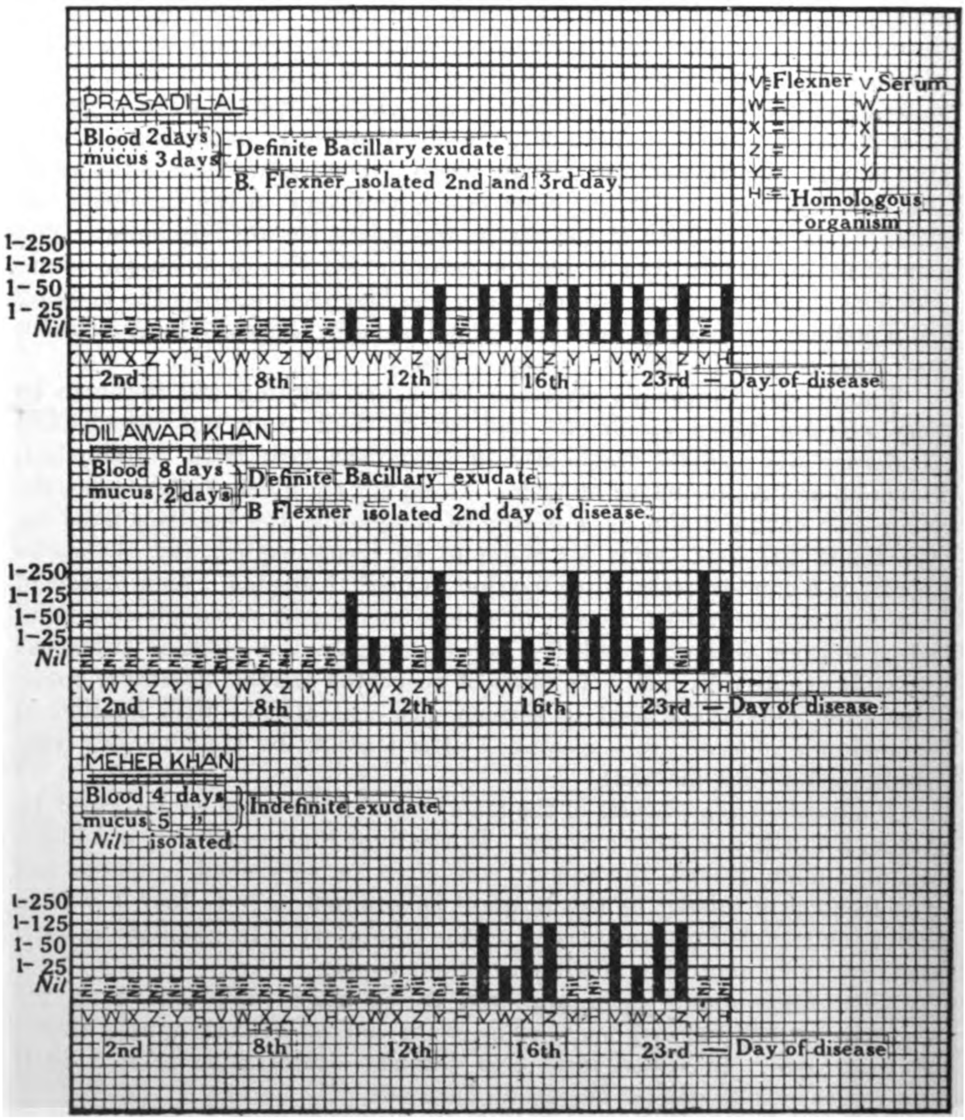

CHART VI.

Importance of Speed in Dispatch of Specimens to the Laboratory.

The time at which the stool was passed was entered upon all laboratory reports sent with the specimen to the laboratory, and was on the whole fairly accurate. At any rate the fact that the time had to be entered

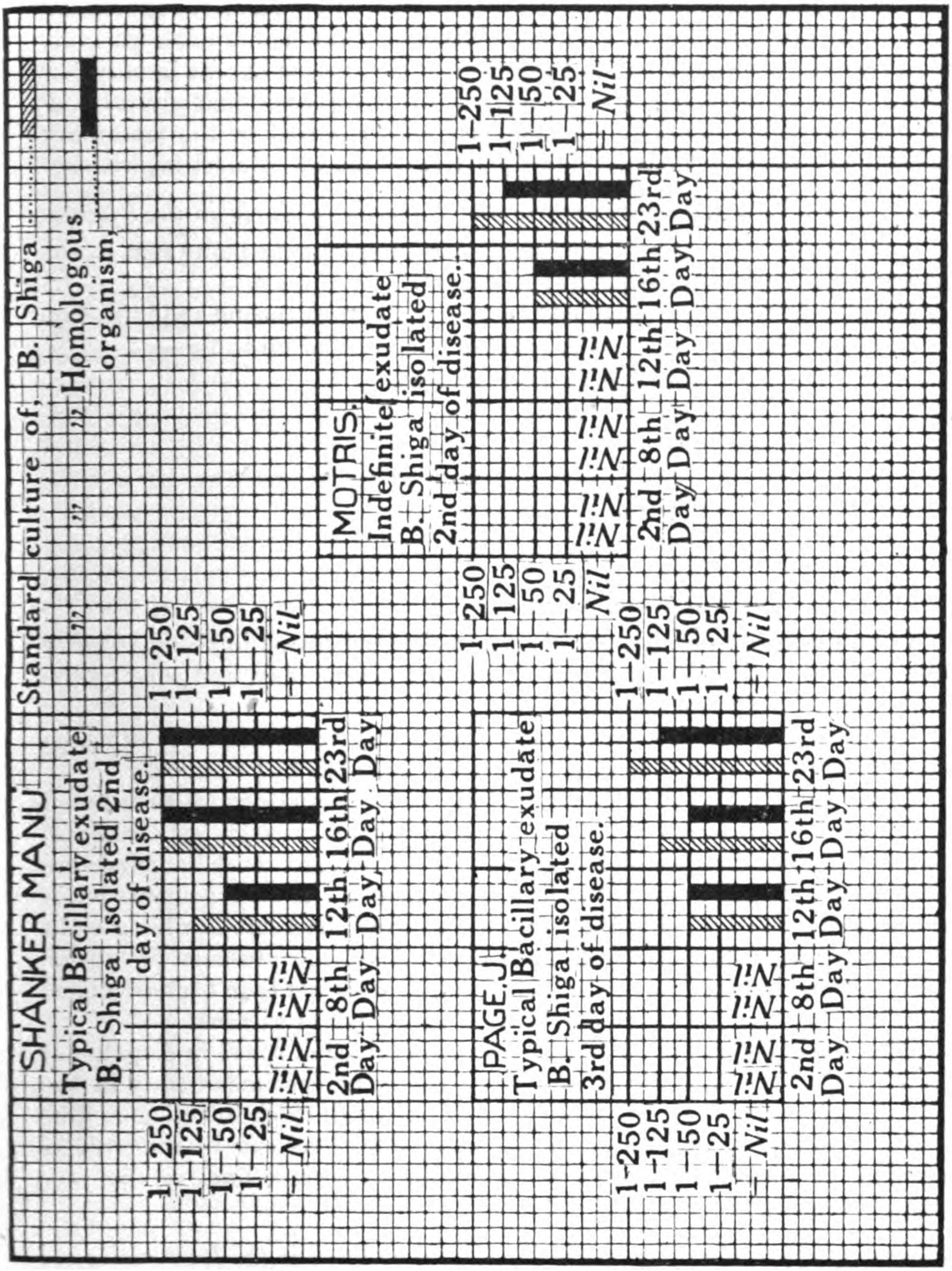
Standard culture of, B. Shiga
" " " Homologous organism,
SHANKER MANU
Typical Bacillary exudate
B. Shiga isolated 2nd day of disease.
MOTRIS.
Indefinite exudate
B. Shiga isolated
2nd day of disease.
PAGE J.
Typical Bacillary exudate
B. Shiga isolated
3rd day of disease.
1—250
1—125
1—50
1—25
Nil
2nd Day
8th Day
12th Day
16th Day
23rd Day

Chart VII.

impressed on subordinates that speed in dispatch was important. On looking through our records the greatest number of *B. flexner* were isolated from fresh specimens received in the laboratory two hours after passage, and even up to three hours, but not beyond this period except in very few cases, unless the specimen had been sent in the thirty per cent glycerine in six per cent saline solution. From specimens received in the laboratory under thirty minutes after passage a positive result was almost invariable.

Importance of sending Specimens to the Laboratory Early in the Disease.

Our records show clearly the importance of specimens being sent to the laboratory as early as possible in the disease.

Positive results were obtained as a rule on the first, second and third day.

In 100 Flexner infections the bacillus was isolated up to the—

4th	day	in	13	instances.
5th	,,	,,	11	,,
6th	,,	,,	7	,,
7th	,,	,,	4	,,
8th	,,	,,	3	,,
12th	,,	,,	1	instance.
14th	,,	,,	1	,,
15th	,,	,,	1	,,

In only six cases in this series was *B. flexner* isolated in the absence of mucus, once on the fifth day, four times on the sixth day, and once on the fourteenth day after onset of the disease.

The isolations on the twelfth and fifteenth day were from cases in which blood and mucus have been absent for a few days but had recurred.

In view of the fact that throughout all our examinations we have found *B. flexner* present in normal stools, without mucus, on such few occasions, the routine examinations of the fæces of Flexner cases once the stools are formed appear hardly worth the time and expense. If arrangements could be made for the patient's stool to be examined macroscopically on eight consecutive days after discharge from hospital for the presence of mucus, the results would probably be equally good, if not better than bacteriological examinations, as regards the detection of convalescent carriers.

The above comments as regards the importance of speed in dispatch of specimens to the laboratory, and the sending of specimens early in the disease apply equally if not more so to cases of *B. shiga* infections. Our results appeared to show that most Shiga infections can be rendered as harmless as Flexner infections if dealt with on correct lines in the very earliest stages of the disease.

Organisms other than Dysentery Bacilli encountered in the Bacteriological Examinations of Bacillary Dysentery Stools.

At the commencement of this investigation we recorded these other intestinal bacilli, but it was soon obvious that if the hospitals and the

laboratory were absolutely up to the mark as regards co-ordination, these other bacilli were only of secondary or of no importance.

In the later stages of the disease organisms of the *B. fæcalis alkaligenes* group were almost universally present and *B. morgan* No. 1 was found in the great majority of cases, sometimes early along with *B. flexner*, but more often from the third day onwards. In some cases where we had failed to find *B. flexner* but large numbers of *B. morgan* No. 1 had been present daily, we endeavoured to find evidence of agglutinins in the patient's serum to this bacillus, but were never successful in dilutions of serum of 1 to 25 or over.

Another bacillus was frequently met with fermenting glucose only, but without gas. This bacillus, although really motile, was often non-motile when first isolated. As it produced indol it might possibly be confused with *B. schmitz* unless subcultured several times, and examined for motility each time. An agglutination test with *B. schmitz* serum of course settled any doubt. We considered this bacillus to be a strain of the Morgan group. Several patients' sera were also tested against this bacillus without result.

B. schmitz was encountered on several occasions and serologically proved. The agglutination results of eleven tests with the patients' serum are given later under serological tests.

Late lactose fermenting organisms in all respects resembling *B. flexner* were isolated in a certain number of cases. It was found necessary to keep the lactose tubes of apparent *B. flexner* for long periods in the incubator to collect these.

Some strains were found to be turning the indicator as late as the seventeenth day. In all nineteen strains were isolated. All were tested by Michaelis acid agglutination test and three gave flocculation. The remainder showed no flocculation. Three of the latter have been agglutinated to a reasonable titre by monovalent Flexner serum, i.e., seventy-five per cent in eight hours, two further strains in low titre. Owing to lack of time we have not completed the investigation of these strains, but hope to do so later. Similar bacilli have never been encountered by us apart from an attack of dysentery during the numerous stool examinations carried out in the past two years.

A coliform organism fermenting glucose and mannite with acid and gas, but not dulcite, and fermenting lactose late (fifth day onwards) was frequently encountered in the late stages of the disease, and in chronic mild cases with few symptoms but abdominal discomfort and occasional passage of microscopically indefinite mucus. In one such case a vaccine prepared from this bacillus was immediately successful in clearing up the condition.

Mixed infections of amœbic and bacillary dysentery we found present in only two per cent of our cases. In these there was present a typical bacillary exudate, and *B. flexner* was isolated, but the condition did not clear up, and eventually *E. histolytica* was found and the case responded at once to emetine.

In one case we isolated from the same specimen of fæces *B. flexner* and *B. shiga*. Both were agglutinated by their specific serum, and by the patient's serum to a titre of 1-250 *B. shiga*, 1-125 *B. flexner*. Presumably the patient was a carrier of one organism, and had received a recent infection of the other.

II. SEROLOGICAL EXAMINATIONS OF PATIENTS SUFFERING FROM BACILLARY DYSENTERY (INCLUDING GROUP).

According to the existing Regulations for the Medical Services in India, a case cannot be diagnosed as bacillary dysentery unless an organism of the dysentery group is actually isolated. If a bacillary exudate is noted, in the absence of the infective organism the official diagnosis is "dysentery group (bacillary exudate)." If no bacillary exudate is reported, the diagnosis remains as dysentery group. Our experience has shown that the presence or absence of a bacillary exudate and the numbers of positive isolations depend on many factors, many of which are outside the control of the laboratory, and that the greater percentage of these "group" infections are really bacillary in origin. Therefore as many cases as possible were tested serologically from all types, "Bacillary dysentery," "dysentery group" (definite exudates or indefinite exudates).

Serum was obtained from patients on the first or second day of the disease, and on the eighth, twelfth, sixteenth and twenty-third day from onset of symptoms.

(1) Serum of cases from whom *B. flexner* was isolated was put up against standard Oxford cultures of *B. flexner* V, W, X, Z, Y, and against the homologous organism on each occasion, i.e., five times over a period of twenty-three days.

(2) Serum of cases from whom no infective organism was isolated was put up in a similar manner against the five Flexner strains, and also against a standard culture of *B. shiga*, both from cases showing definite and indefinite exudates.

(3) On the first test every patient's serum was put up against all the strains of *B. flexner* and *B. shiga*.

(4) Serum of cases from whom *B. shiga* was isolated was put up against *B. shiga* standard culture, and against the homologous organism, at the same intervals of time.

(5) Serum of cases from whom *B. schmitz* was isolated was put up against a formalinized twenty-four-hour broth culture of the stock laboratory *B. schmitz* and against the homologous organism five times in twenty-three days.

(6) The homologous organism used was always a twenty-four-hour formalinized broth culture. In all cases Dreyer's agglutination technique was used, and the Dreyer's tubes were allowed to remain in the water bath at 55° C. for four hours.

Serological Tests on Cases from which *B. flexner* was Isolated and on Dysentery Group Cases.

Throughout the tests "*nil* agglutinins present" indicates that no agglutinins were demonstrable in a dilution of serum of 1-25, the lowest dilution employed throughout.

101 complete serological tests were carried out on the above class of cases.

Definite exudates seventy-nine cases (forty-seven *B. flexner* isolated).

Indefinite exudates twenty-two cases (seven *B. flexner* isolated).

Serological Examinations of the Seventy-nine Different Cases.

Fifty-five (69·6 per cent) show a rise in titre to one or all strains of *B. flexner*. Twenty-two of the fifty-five had *nil* agglutinins present when first examined. Agglutinins were found present for the first time in most of these cases on the twelfth day, and on the twelfth day the rise in titre for the already existing agglutinins became apparent.

The maximum titres reached against the standard Oxford strains by these fifty-five sera are as follows:—

Serum of Fifty-five Patients.

versus

	Flexner V	Flexner W	Flexner X	Flexner Z	Flexner Y
Nil agglutinins present throughout test ..	4	7	17	24	As Flexner V but in rather less proportion
Titre 1- 25	—	13	12	7	
,, 1- 50	10	10	16	10	
,, 1-125	19	8	9	7	
,, 1-250	22	7	1	7	
Total were tested ..	55	55	55	55	

Day of Disease on which Maximum Titre was Found Present among the Fifty-five Cases.

4 cases	(7·2 per cent)	reached highest titre on	8th	day of disease
12 ,,	(21·7 per cent)	,, ,, ,, ,,	12th	,, ,,
11 ,,	(20·0 per cent)	,, ,, ,, ,,	16th	,, ,,
28 ,,	(52·7 per cent)	,, ,, ,, ,,	23rd	,, ,,

From the above figures it will be seen that agglutinins to Flexner V predominated in these patients' sera, being absent in only four cases out of fifty-five, and also that the fifty-five sera agglutinated V in a higher titre on the average than the other strains.

In very few instances did the agglutination reactions to the various strains give sufficient indication of the type of infecting strain of *B. flexner*, as will be seen from the histograms picked at random from those made on these fifty-five tests. Occasionally one strain did predominate, but owing to the irregular appearance of the agglutinins in general, little value could be attached to this.

B. flexner Cases.

From both definite and indefinite exudates fifty-four *B. flexner* were isolated. Thirty-nine of these cases give a rise in titre to the standard Flexner cultures, i.e., 71·9 per cent. Of the fifteen showing no rise, eight cases had an entire absence of agglutinins to *B. flexner* throughout the test. The remainder had agglutinins present when first examined, but these either remained at the original titre or dropped subsequently.

The severity of the cases appears to have had no connexion whatever with the formation of agglutinins. Many of the mildest cases have given good agglutination results, and more protracted cases have failed to produce agglutinins. The following case may be taken as an example :—

Pte. T., January 20, 1926: Blood and mucus four days—*B. flexner* isolated, and agglutinated 1-250 by polyvalent dysentery serum. Complete tests. No agglutinins to any strain of *B. flexner*, including homologous organism.

July 4, 1926: Blood and mucus five days (sharp attack), *B. flexner* isolated and agglutinated by polyvalent Flexner serum 1-250. A complete series of tests again showed no agglutinins, except that on the sixteenth day the serum agglutinated Flexner X to 1-50. On the twenty-third day there were no agglutinins present. The organism isolated was put up against all five monovalent Flexner sera, and was agglutinated to 50 per cent titre by Flexner W serum, and to 2·5 per cent titre by Flexner X serum. The patient's serum did not agglutinate this bacillus throughout.

The homologous organism was agglutinated by the patient's serum in only twenty-two instances (40·7 per cent). The histograms show that in these instances the patient's serum became as a rule capable of agglutinating his own bacillus late in the disease, i.e., on sixteenth to twenty-third day; occasionally in low titre as early as the twelfth day. The organism in many instances was agglutinated by polyvalent laboratory serum, but not by the patient's serum, and, as will be seen later, many were inagglutinable either by the patient's serum or by laboratory serum.

If eight hours had been allowed for agglutination to occur before reading the results, it is probable, in view of our experience later, that a higher titre of agglutination might have been found with the patient's serum, and possibly a larger number of the organisms would have been agglutinated.

Serological Results on Twenty-Two Cases with Indefinite Exudates (seven *B. flexner* Isolated).

Eleven of the twenty-two (50 per cent) showed a definite rise in titre in all respects similar to those discussed above.

From the eleven cases showing no rise, two *B. flexner* were isolated.

Dysentery group cases, i.e., no organisms isolated.

The serological test on these forty-seven cases demonstrated that 57·4 per cent gave a definite rise in agglutinins to *B. flexner*.

28·1 per cent cases from which *B. flexner* was actually isolated showed no agglutinins to any strain of *B. flexner.* It appears to us therefore that, as was suggested by clinical symptoms, most of these group cases are mild Flexner infections.

In none of the 101 cases did any agglutinins to *B. shiga* become apparent in the patient's serum throughout the period of examination (twenty-three days).

Summary of Conclusions on Series of Tests.

(1) 71·9 per cent *B. flexner* infections produced agglutinins to *B. flexner.*

(2) 57·4 per cent "group" infections demonstrated a similar production of agglutinins to *B. flexner.*

(3) Agglutinins to *B. flexner* appeared irregularly usually about the twelfth day, and in most cases were highest on the twenty-third day after onset.

(4) Flexner V agglutinins appeared to predominate, but that this can be taken as an indication that Flexner V is the main infecting strain is doubtful.

(5) The severity of attack bore little relation to the production of agglutinins.

(6) *B. shiga* agglutinins were not found to be present in any of the sera of the dysentery group cases tested.

III.—Serological Examinations.

Serological examinations of British and Indian troops not suffering from dysentery, or on first or second day after onset of dysentery, before agglutinins due to existing attack could become apparent in the serum.

	British troops—66 British troops Per cent	Indian troops—121 Indian troops Per cent
Percentage showing standard agglutination to any strain of Flexner in a titre of 1-25 or over	31·8	50·6
Percentage showing agglutinins to :—		
Flexner V	66	73·9
Flexner W	23·8	26·2
Flexner X	38·1	42·7
Flexner Z	28·6	27·9
Flexner Y	42·9	54·0

The actual titres of agglutination reached against the different strains were as follows :—

British troops	1-25 Per cent	1-50 Per cent	1-125 Per cent	1-250 Per cent		Per cent
Flexner V	18	35	13	..	=	66
Flexner W	14·3	9·5	..	..	=	23·8
Flexner X	14·3	14·3	9·5	.	=	38·1
Flexner Z	14·3	14·3	..	..	=	28·6
Flexner Y	4·8	23·8	14·3	..	=	42·9
Indian troops						
Flexner V	24·6	23	23	3·3	=	73·9
Flexner W	13·1	18·2	4·9	..	=	26·2
Flexner X	16·4	19·7	4·9	1·7	=	42·7
Flexner Z	14·8	11·4	1·7	..	=	27·9
Flexner Y	11·4	21·3	18	3·3	=	54·0

From the above figures it is evident that Flexner V agglutinins are present in a larger percentage and to a higher titre than the agglutinins of the other Flexner strains. Flexner Y appears to be the next in frequency, but as at a late stage in these investigations the standard Flexner Y culture appeared to have become auto-agglutinable, it is felt that the Flexner Y results may not be as accurate as in the case of the other strains used. Although no actual sedimentation was seen in the control tubes, the emulsion may have been unduly sensitive to the action of the serum. Flexner W was found present in a smaller percentage and in lower titre than Flexner X or Z. Higher titres were found to be present in a larger proportion of Indian troops than amongst British troops. In no case was standard agglutination present in a higher dilution than 1-250, and as high as 1-250 in only a small percentage of cases. Sera from all the 187 cases were also tested against a standard culture of *B. shiga*. To our surprise standard agglutination in a titre of 1-25 or over was only found present on three occasions. One, a European of many years' service in India, had been complaining for some time of abdominal discomfort, with occasional passage of mucus. Unfortunately, he refused to have any bacteriological examinations carried out. The other two cases were Indians. Both had suffered from frequent attacks of dysentery, and in both cases *B. shiga* was isolated.

In view of these results, it would appear worth while to consider the question of carrying out serological examinations, using Dreyer's method, and Oxford standard cultures, to detect carriers of *B. shiga*. We had expected to find large numbers, particularly among the Indian troops, demonstrating agglutinins to this bacillus in as low a titre as 1-25. The small proportion of infections with *B. shiga* among the acute dysentery cases, and the fact that none of the "dysentery group cases" examined developed agglutinins to this bacillus, appear also to support the supposition that *B. shiga* infections take only a small part in the normal incidence of dysentery in Poona.

IV. SEROLOGICAL OBSERVATIONS ON CASES OF *B. SHIGA* INFECTIONS.

A complete series of tests were carried out on twelve cases only. That further tests were not made is due to the fact that infections with this bacillus are uncommon (twenty-two from January 1 to September 30), and that some of these infections occurred among women and children, from whom no serum was obtained.

Eight of the cases demonstrated the presence of agglutinins to *B. shiga* by the twelfth day, i.e., 66·6 per cent. These patients' serum also agglutinated the homologous organism on either the twelfth or sixteenth day. With the exception of two cases, the maximum titre was reached on the twenty-third day. The maximum titre varied from 1-125 to 1-250.

The percentage of cases demonstrating the presence of agglutinins was smaller than we expected. But the number of observations is small, and

if further cases had been available the percentage showing the formation of agglutinins would probably have been higher, as has been found to be the case by other observers. In two other cases serum taken from cases on the second day of the illness agglutinated both the homologous organism and the Oxford standard culture of *B. shiga* to a titre of 1-125. Both had a history of previous attacks of dysentery. Four of the cases showed no agglutinins either to homologous organisms or to the standard culture of *B. shiga* in a titre of 1-25. The severity of the attack appears to have had no effect on the formation of agglutinins. Indeed, the most severe attack in the series (raised temperature for twelve days, blood and mucus persisting for nineteen days on and off) showed no evidence of agglutinin response. The patient, in addition, was suffering from *Tænia saginata* infection. The majority of the cases were extremely mild in nature. This, as has been remarked before, was probably due to the fact that patients reported sick on the first or second day of the disease and were promptly treated.

SEROLOGICAL TESTS ON CASES FROM WHICH *B. schmitz* WAS ISOLATED.

Complete tests were carried out on eleven cases. Four of these cases produced agglutinins against the laboratory culture of *B. schmitz*. The extent and period of agglutination are shown in the histograms (Chart VIII).

The homologous organism was in no case agglutinated by the patients' sera. As the stock culture was agglutinated in four cases, this result is probably due to inagglutinability of recently isolated cultures. It should be noted that the organism was agglutinated to a reasonable titre, i.e., 1-250 by laboratory serum 1-500. Presumably the agglutinins in the patient's serum were not sufficiently developed to overcome the inagglutinability of the bacillus.

In view of the fact that *B. schmitz* has been considered by some observers to be a doubtful agent in the production of dysentery owing to the non-production of agglutinins in the patient's serum, the production of agglutinins in these few cases appears worth recording.

V. SEROLOGICAL OBSERVATIONS ON STRAINS OF *B. FLEXNER* ISOLATED.

During the routine serological examinations of *B. flexner*, the inagglutinability of freshly isolated strains had been marked.

Some, after several subcultures, became agglutinable, but a considerable number still remained after many months entirely inagglutinable to a polyvalent Flexner serum of high titre.

Owing to this inagglutinability, it was thought best to collect a fair number of strains and keep them in the hope that as time passed they would become more agglutinable.

In all, 117 strains were put on one side for this purpose, from cases occurring in 1925 and in the early months of 1926. We attempted to type these in August and September, 1926. The results have been interesting,

but on the whole not satisfactory, and for that reason are considered worth recording.

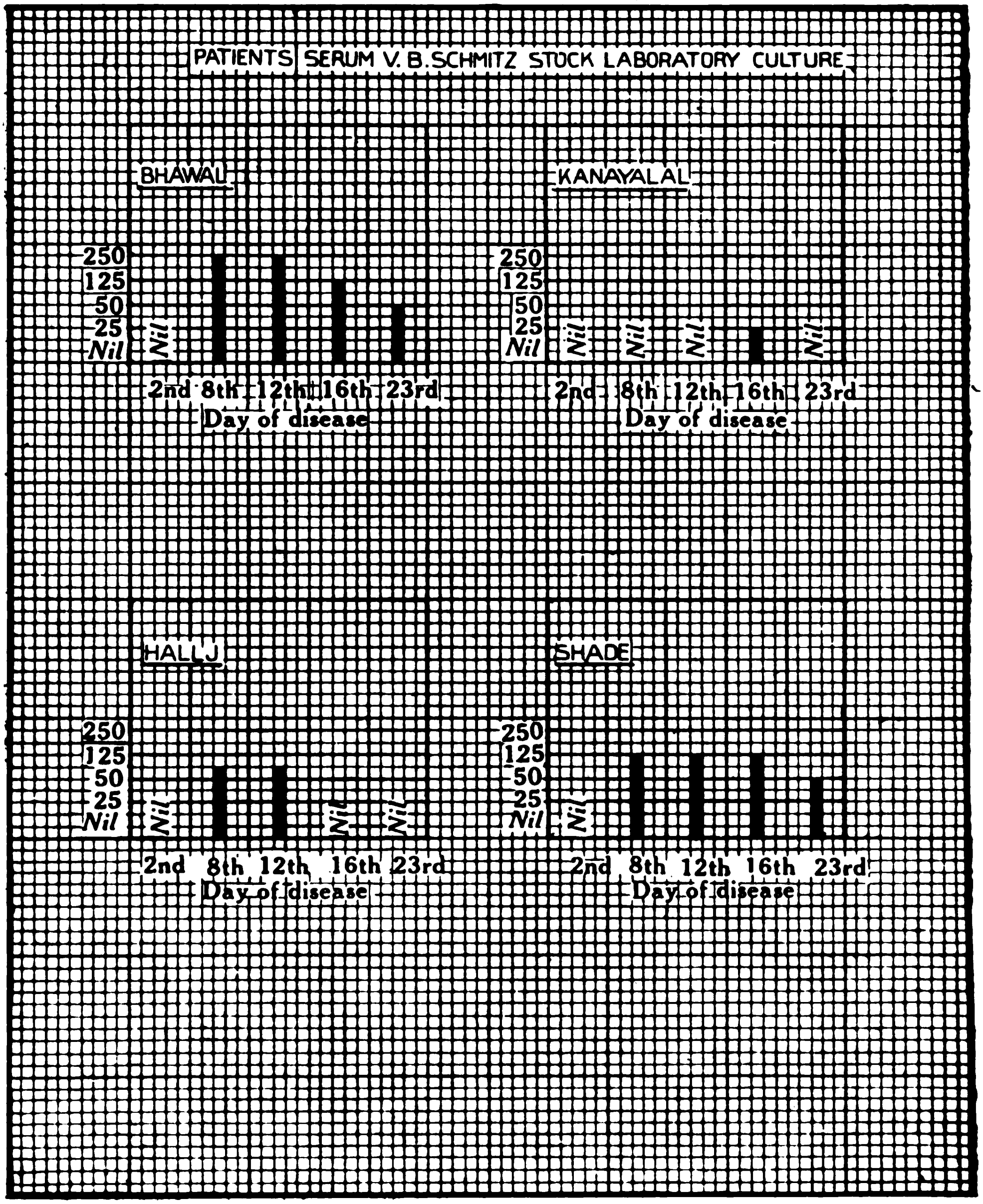

CHART VIII.

We took the Medical Research Committee Special Report Series, No. 42, as a guide, and endeavoured to follow out as far as possible the technique which Professor Andrewes and Dr. Inman had found satisfactory. In the

introduction to this report it is stated that, from 1916 onwards, "It was found everywhere that organisms assignable by culturable and chemical

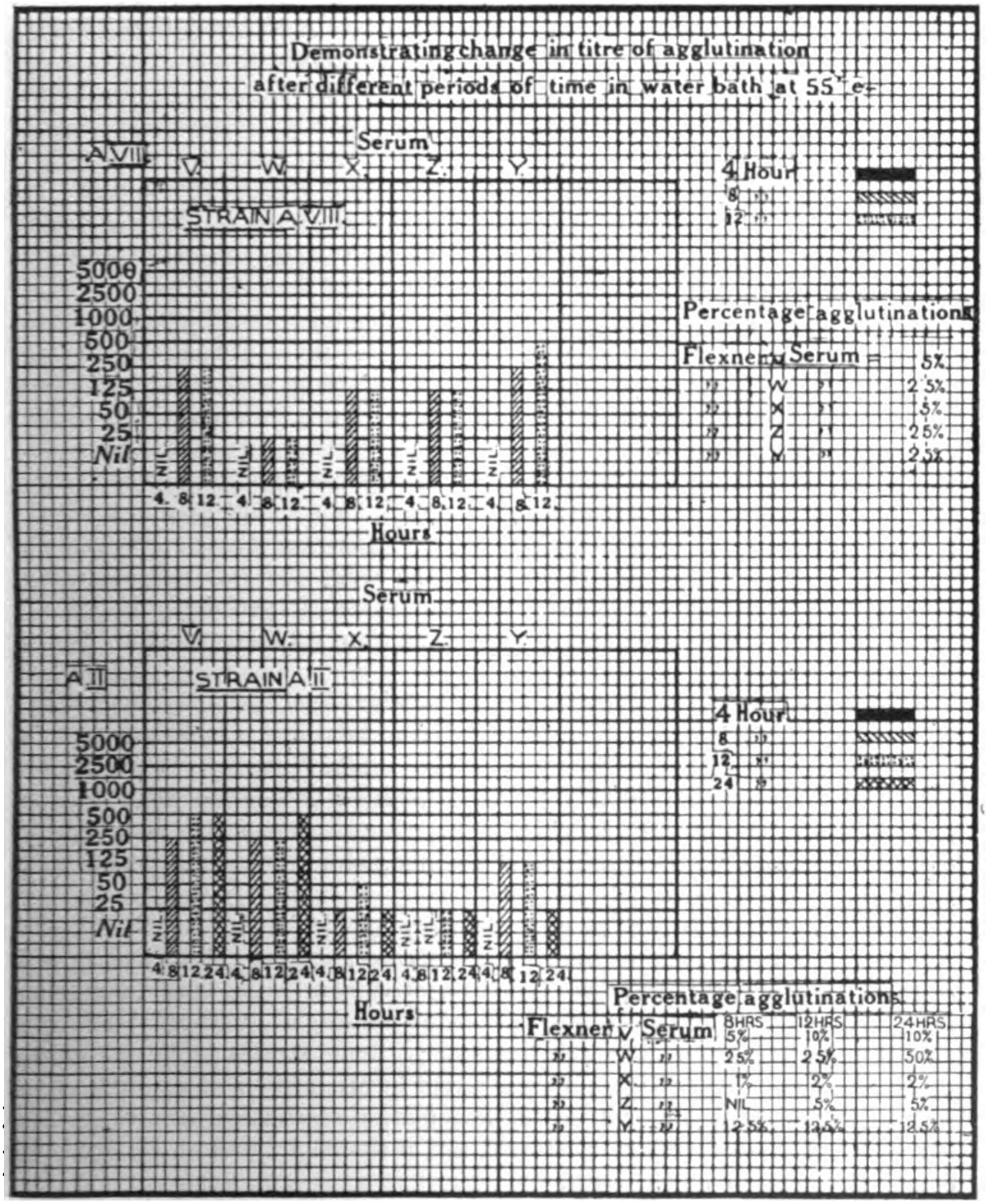

CHART IX.

characteristics to the Flexner group failed to respond to the final test by agglutination."

Strains were collected by these workers from different parts of the world,

and were ultimately assigned to five main strains, and two substrains, i.e., V, Z, and W, X.

The majority of the known Flexner strains were included in these groups, and by the use of specific monovalent sera, it was considered that nearly all the Flexner groups could be assigned to their proper strain.

The methods used in grouping were—

(*a*) Agglutination tests.
(*b*) Agglutinogenesis.
(*c*) Absorption tests.

The agglutination tests were carried out first, and the results were confirmed by agglutinogenesis experiments with the various strains, and finally by the absorption test.

The results of the agglutination test were demonstrated by plotting out the effect of each serum upon the bacillus under investigation, expressing the result as a percentage of the full titre of the serum with its homologous bacillus. It was then possible to show "at a glance" the strain to which the bacillus belonged. It was also found by Professor Andrewes and Dr. Inman that "Flexner bacillus with some exceptions agglutinates with fair readiness, flocculation being nearly complete in four to six hours at 55° C. In certain Flexner strains a delay in agglutination was occasionally noted, but on the whole the difference between the early and late agglutinating species is so striking that it may be regarded as of special significance." The readings throughout their tests were accordingly taken after four hours in a water bath at 55° C.

The agglutination method of typing strains was obviously that most suited to workers such as ourselves in a district laboratory, in which routine work is heavy, and takes up most of the available time. It would be impossible to carry out either agglutinogenesis or absorption tests on the large numbers of Flexner bacilli isolated. Our attention was accordingly directed mainly to the agglutination method, which appeared simple and applicable to any district laboratory.

The 117 strains tested by us were morphologically and biochemically *B. flexner*. All were isolated from dysentery cases, and as a rule on the second or third day of disease. All were Gram-negative non-motile bacilli, fermenting glucose and mannite without the production of gas, and not fermenting lactose up to three weeks in the incubator. Some strains produced indol, others did not. In addition, all were tested by Michaelis acid agglutination test, and none gave any evidence of flocculation at the end of two hours. Some late lactose fermenting strains, not included in this series, did give coarse flocculation by this test.

Method Employed.

Formalin (0·1 per cent) was added to a twenty-four-hour broth culture (Laboratory, Lemco) of the organism to be tested. The formalinized cultures were left in the ice-chest overnight, and next morning were diluted

with normal saline to an opacity as nearly as possible equal to that of an Oxford standard culture. The titres of Flexner V, W, X and Y serum were tested on similar cultures of their homologous organism for each batch of broth made up. The dilution of serum in which each strain tested showed standard agglutination was expressed as a percentage of the titre of the serum to its own homologous bacillus.

Dreyer's method was used throughout, the tubes being left for four hours in the water bath at 55° C., the readings then being taken by artificial light against a black background.

The lowest dilution of serum employed was 1-25, and the highest 1-5,000. The titre of the monovalent serum used varied a little from time to time, but usually the Flexner V serum gave a titre of 1-5,000, and Flexner W, X, Z and Y 1-1,000. Occasionally one or other of the latter was higher in titre.

Results of the Four-Hour Readings.

Of the 117 cultures fifty-one, or 43·5 per cent, failed to show any evidence of agglutination with V, W, X, Z and Y serum in 1-25 dilution, and many of those which did agglutinate did so only in low dilutions. Before attempting to type according to these results, we repeated a large number of the tests, but left the tubes in the water baths up to twenty-four hours, readings being taken at four, eight, twelve and twenty-four hours. We found that the readings were nearly always appreciably higher at eight than at four hours, but in only a few instances was the reading at twelve or twenty-four hours higher than the eight-hour readings.

Also cultures definitely inagglutinable (*nil* in 1-25) at four hours, were often definitely agglutinable by eight hours to reasonable titre. Inhibition zones were extremely constant in most strains, often up to 1-125, and eight hours in the water bath appeared to overcome this to some extent.

As an example, the titre of some of the stock Flexner laboratory serum tested at one period may be given :—

	4 hours' reading	8 hours' reading	12 hours' reading
Flexner V	1-2,500	1-5,000	1-5,000 (Standard +)
Flexner W	1-500	1-1,000	1-1,000
Flexner X	1-500	1-2,500	1-2,500
Flexner Z	1-500	1-500	1-500
Flexner Y	1-500	1-1,000	1-1,000

It will be seen that there is a marked difference between the four- and eight-hour readings, particularly in Flexner X serum.

The increase in titre is shown in the histograms, i.e., strains A viii and A ii showed no agglutination in four hours, but definite agglutination in eight hours. Strains A ix and A xvii show the great increase in the titre found at the eight-hour reading.

The increase in titre did not appear necessarily to alter the grouping of

the strain, as is seen in histograms for strain A ii, presumably a Flexner W. But in some cases it did apparently affect the typing, i.e., strain A ix at the four-hour reading was agglutinated by X serum to 25 per cent titre, and by V serum to only 1 per cent, whereas at the eight-hour reading it was agglutinated by V serum to 50 per cent titre, and by X only to 10 per cent (titre of X serum 1-500 at four hours, and 1-2,500 in eight hours).

It appears to us, therefore, that it is safer to take readings at eight hours in the water bath when endeavouring to place Flexner bacilli in their various categories by the agglutination method, and also when testing by polyvalent or monovalent serum to prove their identity as *B. flexner*. Very many bacteriologists prefer to take their agglutination readings with *B. flexner* at twenty-four hours for similar reasons, but owing to the results given in Medical Research Report Series, No. 42, teaching, we understand, has in late years inclined to be that four-hour readings are sufficient. Such is not our experience.

As a result of the above findings we decided to start again, and once more all the 117 strains were put up against all five monovalent Flexner serum, and the readings were taken after eight hours in the water bath.

Results of the Eight-hour Readings on 117 Strains.

(1) Thirty-three (28·2 per cent) strains were still inagglutinable (1-25), i.e., 15·3 per cent less than that at the four-hour reading.

(2) Of the eighty-four which showed agglutination:—

(*a*) Sixty strains (51·2 per cent) appeared to have one sufficiently predominant antigen demonstrated to enable them to be placed in a definite category.

(*b*) Twenty-four strains (20·5 per cent), although agglutinating, showed only a small percentage of titre of agglutination with the various sera, or else agglutinated to such a high titre and to similar percentages with several sera that an absorption test would obviously have been necessary to settle the question of their identity.

The sixty strains fell into the following groups:—

21	(35·0 per cent)	=	Flexner W.
11	(18·3 per cent)	=	Flexner Y.
10	(16·6 per cent)	=	Flexner Z.
9	(15·0 per cent)	=	Flexner X.
7	(11·6 per cent)	=	Flexner V.
2	(3·3 per cent)	=	Flexner V, Z.

Flexner W being the predominant strain, and Flexner V the least frequent.

As Flexner V agglutinins predominated in the tests on the serum of patients suffering from dysentery, and also in the sera of normal individuals, the above results, if correct, were distinctly unexpected. The above test

relies on the agglutinating power of the serum to overcome the inagglutinability of the organism tested to the same extent with all the sera used, i.e., the serum of the same strain as the bacillus tested should agglutinate it to the highest percentage, and the remaining sera should agglutinate it in diminishing proportions. The agglutinability of *B. flexner* strains has appeared to us to be such an erratic factor, that we feel uncertain that this is the case in reality, except possibly with stock laboratory cultures. Except in the seven strains noted in which Flexner V agglutinins were greatly predominating, the percentage of agglutination titre to the V serum was uniformly low in almost all the strain tests.

Looking up the records of agglutination tests on patients during and after the dysenteric attack, it was found possible in a few cases to compare the patients' agglutinins with the percentage titre of agglutination of the homologous organism against the five standard sera.

Table VI gives the details in five cases from which apparently Flexner W was isolated, two cases of Flexner X infections, three cases of Flexner Z infections, and two cases of Flexner Y infections.

TABLE VI.—COMPARISON OF AGGLUTININS IN PATIENTS' SERUM AND PERCENTAGE OF TITRE OF AGGLUTINATION OF THE ORGANISMS ISOLATED FROM THESE CASES AGAINST FLEXNER V, W, X, Z AND Y.

Agglutinins in patients' serum			Percentage of agglutination of the organism isolated with sera of V, W, X, Z, Y.	
Flexner W strain—			Per cent	
1. Jit Singh, 23rd day	Flexner V.	1-250	1	in Flexner V serum
	,, W.	1-125	100	,, ,, W ,,
	,, X.	1-125	2·5	,, ,, X ,,
	,, Z.	1-50	12·5	,, ,, Z ,,
	,, Y.	1-250	25	,, ,, Y ,,
Homologous bacillus		1-250		
2. Abdulla Bag, 16th day	,, V.	1-50	2·5	,, ,, V ,,
	,, W.	*Nil.*	100	,, ,, W ,,
	,, X.	1-25	5	,, ,, X ,,
	,, Z.	*Nil.*	12·5	,, ,, Z ,,
	,, Y.	1-50	25	,, ,, Y ,,
3. Walters, 16th day	,, V.	1-250	10	,, ,, V ,,
	,, W.	1-50	100	,, ,, W ,,
	,, X.	1-25	37·5	,, ,, X ,,
	,, Z.	1-25	*Nil*	,, ,, Z ,,
	,, Y.	Control ?	25	,, ,, Y ,,
Homologous bacillus		1-50		
4. Tickaram, 9th day	,, V.	1-50	1	,, ,, V ,,
	,, W.	1-125	50	,, ,, W ,,
	,, X.	1-50	2·5	,, ,, X ,,
	,, Z.	1-125	*Nil*	,, ,, Z ,,
	,, Y.	1-250	5	,, ,, Y ,,
Homologous bacillus		1-125		
5. Lall Khan, 23rd day	,, V.	*Nil.*	10	,, ,, V ,,
	,, W.	1-125	100	,, ,, W ,,
	,, X.	1-125	5	,, ,, X ,,
	,, Z.		5	,, ,, Z ,,
	,, Y.	? ?	25	,, ,, Y ,,
Homologous bacillus		1-250		

TABLE VI—*continued.*

Agglutinins in patients' serum			Percentage of agglutination of the organism isolated with sera of V, W, X, Z, Y.	
Flexner X strain—			Per cent	
1. Fateh Mohd., 16th day	Flexner V.	*Nil.*	16	in Flexner V strain
	,, W.	1-125	50	,, ,, W ,,
	,, X.	1-50	200	,, ,, X ,,
	,, Z.	*Nil.*	75	,, ,, Z ,,
	,, Y.	? ?	100	,, ,, Y ,,
2. Oakley, 16th day	,, V.	1-87·5	3	,, ,, V ,,
	,, W.	1-37·5	25	,, ,, W ,,
	,, X.	1-25	100	,, ,, X ,,
	,, Z.	*Nil.*	50	,, ,, Z ,,
	,, Y.	? ?	50	,, ,, Y ,,
Flexner Z strain—				
1. Ram Rattan, 23rd day	Flexner V.	1-25	1	in Flexner V serum
	,, W.	*Nil.*	*Nil*	
	,, X.	1-25	20	,, ,, X ,,
	,, Z.	..	100	,, ,, Z ,,
	,, Y.	1-125	2·5	,, ,, Y ,,
Homologous bacillus		1-50		
2. Supati Manu, 16th day	,, V.	1-125	1	,, ,, Y ,,
	,, W.	*Nil.*	..	,, ,, W ,,
	,, X.	*Nil.*	10	,, ,, X ,,
	,, Z.	*Nil.*	50	,, ,, Z ,,
	,, Y.	1-50	5	,, ,, Y ,,
Homologous bacillus		1-50		
3. Mardan Shah, 23rd day	,, V.	1-250	*Nil*	,, ,, V ,,
	,, W.	1-25	*Nil*	,, ,, W ,,
	,, X.	1-25	*Nil*	,, ,, X ,,
	,, Z.	1-25	50	,, ,, Z ,,
	,, Y.	1-125	*Nil*	,, ,, Y ,,
Homologous bacillus		1-125		
Flexner Y strain—			*Nil*	in Flexner V serum
1. Mitchell, 23rd day..	Flexner V.	1-250	5	,, ,, W ,,
	,, W.	1-25	25	,, ,, X ,,
	,, X.	1-125	12·5	,, ,, Z ,,
	,, Z.	1-50	50	,, ,, Y ,,
Homologous bacillus	,, Y.	1-125		
2. Yates, 23rd day	,, V.	1-250	7·5	,, ,, V ,,
	,, W.	1-25	37·5	,, ,, W ,,
	,, X.	1-50	100	,, ,, X ,,
	,, Z.	1-125	50	,, ,, Z ,,
	,, Y.	1-250	200	,, ,, Y ,,
Homologous bacillus		..		

If the typing of strains by the above method is correct, the agglutinins produced in the patients' serum correspond in very few cases with the strain of the infecting organism, and, as will be seen, V agglutinins appeared to predominate in the patients' serum in nearly every case irrespective of the strain of the infecting bacillus.

The agglutinogenesis of strains was tested in two cases picked out at random:—

(1) In one of these, Ram Rattan, we had records of the test on the patient's serum. From the Chart XI it will be seen that this strain by the agglutination method would have been classified as a probable

Flexner Z (Z 50 per cent, X 20 per cent, V and Y 1 per cent), whereas the rabbit serum prepared from this bacillus agglutinates Flexner V to full titre, and Flexner Z hardly at all—the organism in question

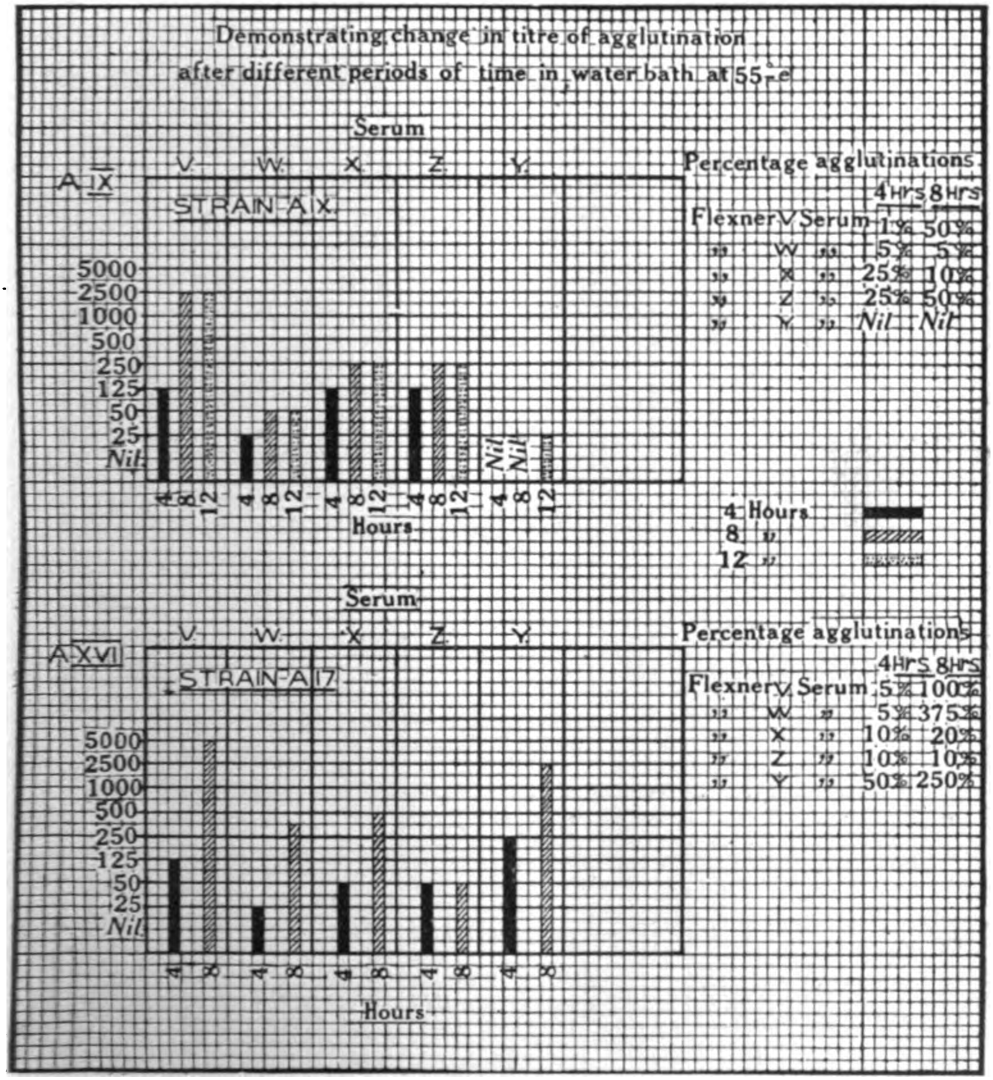

CHART X.

being undoubtedly a Flexner V. The agglutinins produced in the patient's serum agree with the latter finding.

(2) Strain Giridhar Lal demonstrates well the inagglutinability of some of the cultures (this strain was isolated early in 1925). From the agglutination test it could not be placed in any strain

owing to the low percentage of agglutination (V 1 per cent, W 2·5 per cent, Y 5 per cent); apparently the organism is a Flexner Y. This strain was inagglutinable in four hours.

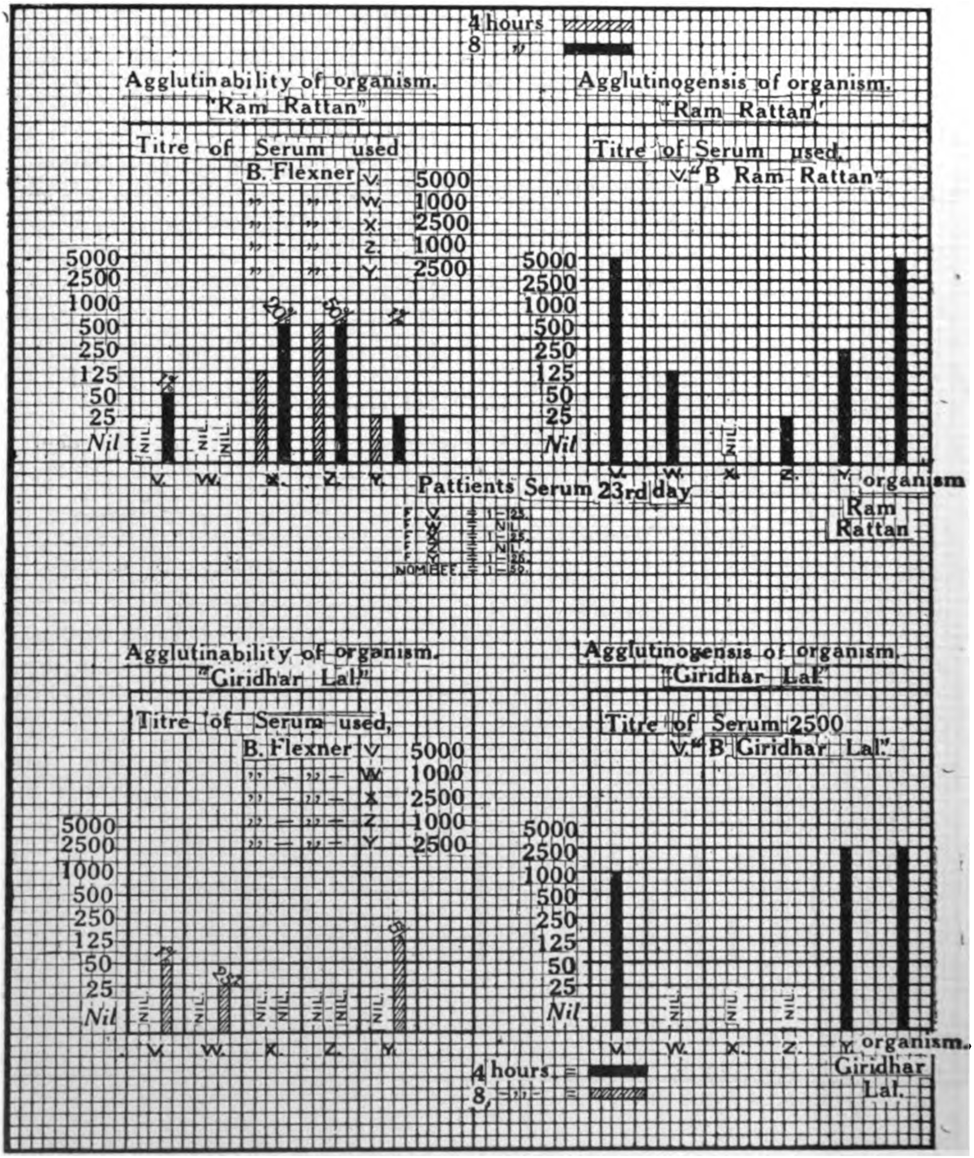

CHART XI.

In at least one instance, therefore, in which the agglutination method was checked by the agglutinogenesis the former appears to have given an incorrect reading. A 50 per cent titre is possibly not much to go upon,

but the homologous serum in this case only agglutinated the bacillus to 1 per cent titre, whereas a heterologous serum (Z) agglutinated it to 50 per cent titre.

INAGGLUTINABLE CULTURES.

Four strains were picked at random from amongst the thirty-three absolutely inagglutinable bacilli in order to test the agglutinogenesis of these organisms.

In Research Report Series, No. 42, Professor Andrewes and Dr. Inman state that a single dose of ½-1 cubic centimetre formalinized broth culture given intravenously commonly yields a serum of titre 1-1,000 in a week, and that a repetition of the above suffices to raise the titre to 1-3,000, or more.

This also in the past had been our experience while working with stock laboratory cultures of *B. flexner*, except that ¼, ½ and 1 cubic centimetre doses were given at four-day intervals. No difficulty had been obtained in producing a serum of high titre.

Our experience with these inagglutinable strains, however, has been entirely different, and in only two of the four cases could a serum of reasonable titre be obtained, and then after considerable trouble. One strain produced an agglutinating serum with comparative ease, and turned out to be a Flexner Z.

With the other strains live cultures, in doses of ½ and 1 cubic centimetre, were eventually employed, after numerous doses of dead cultures had been given, with the result that several rabbits were killed. A serum of high titre was eventually obtained with only one of these strains (strain Finch). With the other two strains a serum with titre higher than 1-250 could not be obtained, and as a result they were useless for our purpose.

Apparently inagglutinability and weak agglutinogenesis correspond in many instances among the Flexner strains. Strain Finch had been isolated in the early months of 1925, and had remained entirely inagglutinable to Flexner V, W, X, Z and Y serum until September, 1926, when a trace of agglutination was evident in a dilution of 1-50 W serum. The serum (titre 1-5,000) prepared from this strain did not agglutinate either V, W, X, Z or Y Oxford laboratory standard cultures. It was put up against 29 other strains (14 inagglutinable and 15 indefinite), and agglutinated 6 of these heavily in six hours, four further strains in twelve hours, and the majority of the remainder showed faint granulation in 1-25 or 1-50 at twenty-four hours. This granulation did not appear to us to resemble true agglutination, but was more in the nature of a fine precipitation, and this appearance seems to us an argument against taking readings at such a late stage. As one of the writers was transferred from the laboratory, almost directly after these tests were done, further work on this bacillus had to stop for the time. But it appears that we are dealing here with a strain of *B. flexner* which bears little or no relationship to the five standard

strains. One of the assistant surgeons attending a course in the laboratory has been found to have agglutinins present to this strain in a titre of 1-125.

Probably among these definitely inagglutinable bacilli there are others not included among the recognized strains.

Although incomplete, we think these results worth recording, as several D.A.D.P.'s, not only in India but in other parts of the world, have been finding that polyvalent Flexner serum or monovalent Flexner sera made from the five standard strains of *B. flexner* have not yet solved the problem of the inagglutinability of the Flexner strains.

In time organisms undoubtedly become more agglutinable. In fact, an Oxford laboratory standard Flexner Y culture had become auto-agglutinable. We have kept strains now well over a year, and still some remain inagglutinable. The final serological proof of the identity of a bacillus as *B. flexner* must therefore, from a practical laboratory point of view, be absent in many instances. One cannot wait two or three years before giving a final diagnosis. The bacteriologist must therefore still depend mainly on the morphology, cultural and biochemical characters of these organisms for his diagnosis, apart from serological proof. We personally consider that these are sufficient from a practical point of view.

Final serological proof can only be carried out on all strains when some method of reducing the inagglutinability is found. We endeavoured to do this by growing strains in broth to which various percentages of glucose had been added, but in every case the resulting cultures were definitely auto-agglutinable.

It is regretted that the serological investigations had suddenly to cease, owing to the unexpected transfer of the writer to duties outside a laboratory. It was intended to make sera from all the apparently Flexner W strains, and carry out agglutinogenesis and absorption tests in every case, our feeling being that many of these strains might prove to be other strains of *B. flexner* than Flexner W. We had hoped to examine carefully the group of inagglutinable cultures which were agglutinable with serum of strain Finch, and if possible to investigate similarly the other inagglutinable cultures. The relationship of the few lactose fermenting bacilli which agglutinated with Flexner serum, to *B. sonne* on the one hand and *B. flexner* on the other, would also have been investigated. The enormous number of Flexner strains available in the military laboratories in India supply a large field for study, and it is hoped that other Deputy Assistant Directors of Pathology will complete this work in the near future.

Summary of Results.

(1) Of 117 strains, 71·7 per cent only are agglutinable by Flexner V, W, X, Z and Y serum after many months' subculturing.

(2) Four hours in the water bath at 55° C. are insufficient to overcome inhibition zones, and inagglutinability. Eight-hour readings have given

higher titres of agglutination, and reduced the number of inagglutinable cultures by 15·3 per cent.

(3) Only 51 per cent of the agglutinable cultures examined could be assigned to definite strains by the agglutination method given in Medical Research Series Special Report, No. 42.

The results did not correspond with those found in the serological examinations of the patients' serum, and in one case at least were proved to be incorrect on ascertaining the agglutinogenesis of the infective strain.

(4) Agglutinogenesis experiments and absorption tests are probably required for a definite typing of most strains of *B. flexner*, except old laboratory cultures.

(5) Inagglutinability and lack of agglutinogenetic power appear to be closely related.

(6) Evidence of at least one strain with apparently no antigenic relationship to *B. flexner* V, W, X, Z and Y, has been found, and there are probably many others.

HELPERS IN HYGIENE.[1]

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'Let us, greatly daring, parody the "immortal William" and say:—

> "To *help* or not to *help*; that is the question:
> Whether 'tis nobler in the *end* to suffer
> *The ills and maladies which sore beset us,*
> Or to take arms against a sea of troubles,
> And by opposing end them?"

"By opposing end them." "Ay, there's the rub," as Shakespeare exclaims in "Hamlet" a little later. True, he is speaking of mental troubles. His second line unaltered, runs, "Whether 'tis nobler in the *mind* to suffer," while to-day the prevention of both mental and bodily ailments must form our theme if we are to consider adequately the campaign that has been waged and is being waged in the great cause of public health, a campaign in which your support is desired, both for your own sakes and for that of the visitors who flock to your attractive island. Is it possible by active opposition, by a well-organized campaign, to exterminate those diseases which dog mankind from the cradle to the grave, some of which are indeed operative before his cradle days and which, even when the grave has claimed him, may continue to plague his offspring, having been transmitted from parent to child? The answer is that, in the case of those maladies about which we are well informed, and more especially in the case of what are called communicable diseases, it *is* in many instances possible, if only we had the courage, tenacity, enthusiasm and, let me add, unselfishness to cope with them properly, and if the public were so educated and became so enlightened that, in all grades of society, there was a vast army of helpers, instead of, as at present, many who help and more who hinder. Happily, this disproportion is yearly growing less, and ere long the helpers will outnumber the hinderers. Even so, it will take many years before our opposition to diseases will end them. Yet in certain directions the goal is in sight and the dream which has been dreamed by several great "helpers in hygiene," as they may be called, is no longer to be regarded as a fantasy or a vague ambition.

The remarkable changes which the last five-and-twenty years have witnessed would have heartened one keen helper in hygiene, the late Sir Benjamin Ward Richardson, a Victorian pioneer and somewhat of a seer in his day. He was the author of a notable book entitled, "The Health of Nations," which all those interested in the history of hygienic endeavour should study, but, for our purposes this evening, I would rather cite a passage in his "Vita Medica," that autobiography which he completed in 1896, two hours before he was seized with fatal illness. He has therein a chapter entitled, "Efforts towards the Extinction of Disease," wherein he says:

[1] An Address delivered under the auspices of the Isle of Man Red Cross Society at the conclusion of Health Week, March 4, 1928.

"The best idea, therefore, is that the disturbance or catastrophe called disease—excluding accidents—is not simply to be met by treatment, although that may be necessary and beneficial, but is to be prevented, and that with so much perfection that it shall altogether become extinct, or remain as a mere historical ghost."

Another prophet, though possibly a somewhat optimistic one, who happily is still with us, was the distinguished zoologist, Sir Ray Lankester, when he wrote, a good many years ago, that if we could only apply our present knowledge properly, all communicable disease could be stamped out in the short course of fifty years.

Now, neither of these men, shrewd, scientific, and well-informed, would have ventured to make such statements unless he had good reason for believing them to be true. They *had* good reason, for, within the lifetime of each, a veritable revolution had been wrought in our knowledge of the causes and spread of those diseases which can be transmitted from man to man or from some lower animal to man, with or without the aid of an intermediary; in other words, indirectly or directly.

It was the work of Pasteur, the greatest helper hygiene has known, which succeeded in dragging into the light secrets which had lain hidden since the beginning of things, secrets which men had from time to time suspected, which some of them had even explored to some extent, but the true significance of which eluded mankind until the genius of the great Frenchman revealed the mystery of the micro-organism and showed the part which lowly forms of life play in human, animal and plant pathology.

Hard on his heels came Koch, and, as a malady with a *direct* transmission from man to man, we may take pulmonary tuberculosis, the causative organism of which he discovered and thereby enabled us to fight the great white plague in a manner formerly impossible. For an example of a disease where the transmission is *indirect*, let us turn for a moment to the tropics. Manson, working at filariasis in China, discovered that the filaria bloodworm was transmitted from the infected person to the non-infected through the agency of a mosquito. He thereby introduced a new and most important idea into the domain of human pathology, namely, the necessary intervention of a blood-sucking insect as a vector or carrier of infection and as a host for a parasite causing a human disease; a host, in the tissues of which the parasite had to undergo a certain development before it was able to enter the body of a second human being and therein reproduce the disease of which it is the cause. In the fullness of time this idea was, at Manson's instigation, applied by Ross to malaria, with the result that the mystery which had for so long shrouded the life-history of that devastating disease was finally dispelled, and new methods for its control and prevention were discovered.

It is of course, as a rule, easiest to master a malady when, as in the case of malaria or plague, which was such a terrifying enigma to our

ancestors, we know both the parasitic cause and the method of transmission, but, in some instances, even though we are ignorant of the cause of a disease, our knowledge of how it is transmitted enables us to cope with it effectively. The most outstanding example of the benefit of such *partial* knowledge is to be seen in the case of yellow fever. The actual cause of "yellow Jack" remains a matter for conjecture, but, thanks to the work of Reed and his colleagues in Cuba as the last century was drawing to a close, we know for a certainty that a species of mosquito is the vector of the virus or poison, whatever that may be, and, as the habits of this mosquito make it comparatively easy to deal with, at least in the New World, a great triumph has been won and the dreaded fever of ships and seaports and of sailors, as well as of other classes of the community, is no longer, as of yore, a scourge and a menace. Now the tropics are far away, and you may say to yourselves, "Quite so, all that is no doubt interesting, but it leaves us a little cold. Can the matter not be brought home to us?" Of a surety it can. Indeed, this was done for the one type of disease when plague was mentioned, for bubonic plague used to ravage England. It has vanished from this country, and nowadays, even if occasionally it is introduced from abroad, the full knowledge we possess regarding its cause, the plague bacillus, and mode of spread, from rat to man through the agency of the rat-flea, enables us to view the presence of a few cases at some port like Liverpool or Glasgow with equanimity. However, let us cite also typhoid fever, once common enough in all conscience, now rare and becoming rarer because we know that it is due to the *Bacillus typhosus*, and we know that this organism reaches man, through the medium of food or water to which it has gained access, directly or through fingers or flies, from the source of infection, and, knowing these things, we have and we exercise the power of prevention.

For the other type of disease, that for which yellow fever stands pre-eminent in the tropics, we may take typhus or spotted or gaol fever, at one time a very real danger in this country, but at the present day almost as extinct as the dodo or the great auk. Here, again, we have no certain knowledge of the cause; scientists continue to squabble about it, but happily there has been proved beyond all doubt the truth of the saying, "No lice, no typhus," and, as lice have little chance in a contest with a health officer, typhus fever, the unknown parasite of which they transmit, has ceased to fill the cemeteries.

So far, so good, but it is of interest to reflect that long before Pasteur revealed the world of microbes, and Manson showed how insects play a part in the spread of disease, many helpers in hygiene, by careful observation and sound reasoning had reached conclusions which, when they translated them into action, yielded very gratifying results. True, these men worked in the dark, but they did get hold of some essential facts and so, long before anything was known about the rôle of lice in typhus fever, Lind, the great naval surgeon of the eighteenth century, indicated clearly

and correctly what measures would prove effective against that complaint. Similarly other observers noted the connexion between dirt and diseases of various kinds, notably such intestinal disorders as diarrhœa and dysentery, and preached and practised a hygiene of environment. Long ago, in Scotland, there was a proverb, "The clartier (that is, the dirtier), the cosier," but the slogan of the health reformers was very rightly, "The dirtier, the deadlier," and the deadlier, remember, not only to yourself and your family, but to your neighbours and fellow-citizens. These early reformers were very largely like voices crying in the wilderness. Few heeded them, save in communities like the Army and Navy, where, if the officers commanding were believers, disciplinary measures could be taken, or where pressure could be brought to bear on local authorities and the Government, as when John Howard, shocked and horrified by the condition of the prisons, raised his voice and testified against them.

Mead and Howard, Percival, Ferrier and Currie, the civilians, Lind, Trotter and Blane, the naval surgeons, Pringle, Monro and Jackson, the Army hygienists, lived and laboured and accomplished much good in a limited way. The country doctor, Jenner, by introducing vaccination, conferred upon suffering humanity one of the greatest boons ever vouchsafed to it, and radically altered the situation with respect to small-pox and its victims. It was not, however, until Chadwick, the lawyer, came upon the scene and, with fearless enthusiasm, dogged determination and no little pugnacity, took up the cudgels on behalf of health, that any real and widespread progress was made, apart from what the good Lord Shaftesbury accomplished in the way of factory reform. Then and thereafter, however, a marvellous change ensued, mainly as a result of an organized campaign for cleanliness. What a fight it was, against superstitions and vested interests and supineness and bitter opposition! Although it is true that reform was in the air, that it was a period of quickening and advance in several directions, perhaps the battle might never have been successful had not the country been visited periodically by outbreaks of cholera which swept away hundreds. The scared populace was thankful to listen to those who brought a message of hope, more especially when Dr. John Snow showed that cholera was spread by the intestinal discharges of the sick, and indicated polluted water as a source of infection. It was in great measure fear which made the people of England loosen their purse-strings and provide the wherewithal to obtain pure water, clean dwellings, an efficient removal and disposal of filth and refuse, but, to do these Victorians justice, once they realized they were getting value for their money they gladly bore the burden and so reaped the reward.

There were, however, other directions in which these early helpers of hygiene exhibited activity. The health of the individual was not altogether neglected, though it is true that, for the most part, the individual received attention chiefly because he formed part of a community. It was, in other words, communal, rather than personal, hygiene to which the earlier

workers devoted themselves. Take, for example, Lind's efforts to get scurvy stamped out of the Navy by the issue to the individual sailor of a ration of lemon juice. Consider how the individual slave benefited from certain efforts affecting his personal welfare, made by Wilberforce and others in their campaign against the appalling conditions of the trade in black ivory.

Until quite recently, I fancy that few had any idea that some of the recent developments on which we pride ourselves had their counterparts long ago. Dr. Mabel Buer, of Reading University, has unearthed some interesting facts which show that considerable attention was paid to infant and child welfare in the latter part of the eighteenth and the beginning of the nineteenth century. There was actually a baby clinic in London in 1815, the year of Waterloo.

Now whence came these more enlightened ideas on the saving of young lives? From a study of the ancient Greeks, that nation of heroes, athletes and philosophers, who certainly were well versed in all matters relating to bodily health? It is unlikely. From the ancient Romans, that race which performed remarkable feats in sanitary engineering, and had inherited some of the hygienic wisdom of the Greeks? It is improbable, for the Romans appear to have had little thought for child life.

I cannot help wondering if it was not a legacy from a very remarkable man, a great helper in hygiene, and, indeed, not only a helper but a leader. So far as I can discover, his name and fame have in this country been wholly forgotten, though upon the Continent, where he lived and worked, they are remembered, and they are known also to certain American hygienists. Perhaps in England there has been too great a tendency in matters hygienic to say we are, or were, the people, and wisdom remains with us. In other words, knowing that England led the way in public health legislation, English students of the subject are a little apt to imagine that modern hygiene originated in this country, and are not disposed to look abroad and see what other nations had done in pre-Chadwickian days. It is true that the English first, of all peoples, placed hygiene on a sound basis, established a definite system of organized sanitary control, and enlisted the power of the law in regulating and enforcing public health procedure. Let us, however, remember that when England was sunk in dirt and squalor the cleanliness of the Dutch was proverbial, and let us pay homage to the memory of that leader of whom I spoke, who was no other than John Peter Frank.

You will not find his name in the "Encyclopædia Britannica," though quite a respectable space is devoted to another Frank, one Jakob, who, of all things on earth, was a Jewish theologian! Yet our Frank was once a name with which to conjure, and Napoleon, no mean hygienist himself, tried in vain to obtain his services. He was born at Rotalben, in Bavaria, in 1745, the year before Culloden, when the death-rate in London was 50 per 1,000—in 1926 it was 11·6—and life had an uncertainty about it to which it is now a stranger, save in the matter of motor vehicles. His

father was French. After studying at Heidelberg, Metz, and Strasburg, he gravitated to Göttingen and then to Pavia, eventually becoming Director-General for Sanitation in Lombardy, somewhere about 1786. Think of that! In 1795 he was called to Vienna by the Emperor of Austria as consultant for the health of the troops. Thereafter we find him as a Professor at Wilna, then at St. Petersburg, and finally back again in Vienna, where he died, full of years and honours, in 1821.

He must have been a man of courage and humour. When he lay dying there were eight eminent doctors round his bed who had been summoned to attend him. He smiled and said: "This reminds me of the end of a French soldier, wounded by eight musket shots at the battle of Wagram. 'Morbleu!' said he, dying, 'it takes not less than eight bullets to kill a French grenadier.'"

Frank was a voluminous writer and covered a wide field, but I mention him to-night because as a hygienist he was far ahead of his period, and because he wrote a truly astonishing book, entitled, "A Complete System of Police Medicine."[1] This, the first authoritative work dealing with public hygiene, appeared in successive volumes between the years 1779 and 1817.

It dealt with nearly every aspect of hygienic activity, including what we are pleased to regard as modern developments. The author writes on sexual hygiene and maternity and child welfare. He discourses on the education of children. He considers the value of foundling institutes and orphanages, and looks at schools and gymnasia from the public health standpoint. A volume is devoted to the problems of nutrition, food and drink being considered and the importance of moderation stressed. Housing is discussed and health conditions generally. The question of cemeteries is not forgotten, and there are disquisitions on the healing art and on schools of medicine. The importance of veterinary knowledge and its relations to medicine receive attention, and altogether it is startling to find how Frank anticipated posterity. I can find no record of his great work being translated into English or even into French, but a treatise which he wrote on the method of rearing healthy children was translated into the latter tongue, and hence it is conceivable that it was *his* influence which led to the early movements in infant welfare of which we have spoken. In addition to being a great clinician, a man of affairs and an illustrious hygienist, Frank was a dreamer of dreams. He formed the conception of a State guided by public health considerations, a kind of Utopia wherein Hygeia should reign supreme, and where affairs would be conducted for the true and lasting benefit of mankind. It is not surprising that, with his knowledge and acumen, he should have conceived such an idea when, all around him, he saw the misery and wretchedness produced

[1] Its German title is "System einer vollstandigen medicinischen Polizey." The word "Polizey" here has a wider significance than "police." It may perhaps be translated "public security."

by successive wars and reflected on the welter of intrigue and politics as well as on the endeavours of the proletariat to obtain a place in the sun. Remember, he lived through the days of the French Revolution, when, with much that was vile and repellent, there were the germs of great things and indeed, in some ways, the beginnings of a new world.

Whatever may have been Frank's influence on England, there can be no doubt he left his mark on the State medicine of Germany, Scandinavia and Russia, but he lived, for the most part, in troublous times, and even after his death the continental nations had not the means to put his precepts generally into practice. The man who followed him was Max von Pettenkofer, but we need not consider his exploits as a helper in hygiene.

Rather let us skip the intervening years, including those when Sir John Simon, as Dr. Simon and Central Medical Officer to the General Board of Health, was making history, ably assisted by Southwood Smith and others, albeit remembering that Lecky has penned a noble epitaph for these stirring and fruitful times. He wrote: "The great work of sanitary reforms has been, perhaps, the noblest legislative achievement of our age, and, if measured by the suffering it has diminished, has probably done far more for the real happiness of mankind than all the many questions that make and unmake ministries."

Its history is set forth in Simon's classic, "English Sanitary Institutions." The fight was won but the position had to be maintained, and furthermore, it soon became evident that the victory, though great, was not complete. In addition it came gradually to be recognized, as Frank had long before envisaged, that new methods of warfare had to be adopted. Let us dwell on these matters for a space.

To maintain the position an adequate health organization was required, and that is why England and Wales have now a Health Ministry, advised by a chief medical officer. Its Medical Department has separate sections dealing respectively with general health and epidemiology; maternity and child welfare, in which section very fittingly a woman is senior medical officer and the medical officers and inspectors are all women; tuberculosis and venereal disease; the supervision of food supplies; general practitioner services; sanitary administration in relation to infectious diseases, and Welsh Board of Health to deal with the public health interests of the principality.

I will comment on some of these immediately. Meanwhile, let us continue the tale and note that other central departments of Government have important health interests, and so are helpers in hygiene. The Board of Education with all its responsibilities for the health of school children and the sanitary condition of schools, the Home Office with its control of the health conditions in factories, mines and workshops, are appropriate examples.

The duties of the Medical Department of the Health Ministry are,

speaking broadly, advisory and supervisory, and cover a wide range which you will find listed in that masterly memorandum, written by Sir George Newman, and entitled, "An Outline of the Practice of Preventive Medicine." Every community intent on hygienic progress and, more especially, every backward community striving to amend its ways, should be familiar with its pages. Perhaps the type of the Ministry's activities which will appeal most strongly to an audience of this kind is that whereby an expert is sent from the Ministry to assist the local health officer of a district where either some obscure infectious disease has made its appearance, or where some communicable disorder is prevailing as an epidemic and has not yielded to ordinary measures. Medical officers of health greatly appreciate such skilled help, which is also naturally of very definite benefit to the local community and sometimes to the country as a whole.

The official local helpers in hygiene are the councils of the areas into which the country is divided. These are the County Councils. There is, as you know, a county of London, and that county, small in area but packed with people, has its council, and the council has its medical and health organization, a large and most important department charged with most onerous duties.

Outside London the work of the County Councils is reinforced by that of the Local Sanitary Authorities, be they urban, rural or port. There are three types of urban local authorities, namely, the county boroughs, the municipal boroughs and the urban districts, all acting through their respective councils. The county boroughs are represented by big towns, each with more than 50,000 people, the municipal boroughs are as a rule smaller towns, the urban districts, as the name implies, are also townships and may indeed be very large and important places which happen never to have had conferred upon them by Parliament the title of County Borough. As a type take Gosport, with its 33,000 people. The rural authorities are the councils of rural districts, which vary a good deal but which all answer to the description of country districts with comparatively small and scattered populations. In these districts, however, there may be small towns or clusters of villages. The state of matters as regards ports varies in different places and may be distinctly specialized. Great ports like London and Liverpool, for example, are under different guidance and control in health matters to the cities whose names they bear.

Now the councils of the above-mentioned boroughs and districts are concerned with various aspects of local government—not only with health work—and so, as a rule, at least in places of any size, the care of the people's health is entrusted to a Public Health Committee. Such committees consist for the most part of laymen, and hence must have executive and advisory officers who are experts. These experts are the medical officers of health, and in all important places, and I think I may say in all progressive and thoroughly up-to-date places, the medical officers of health are full-time officials. Here, in the great towns, the lesser towns, the

villages, the countryside, we find what Newman calls the fighting-line of the never-ending, though usually unobtrusive campaign against inefficiency, disease and death. The medical officers of health and those who assist them and work with them, the sanitary inspectors, health visitors and nurses, are, like Uriah the Hittite, in the forefront of the battle. So, too, are the executive officers of port health authorities. It is these men and women who are actually up against the forces of death, and remember that under the banner of the arch-destroyer there marches a multitude of legionaries, communicable and non-communicable diseases, ignorance, poverty, vice, drink, gluttony, greed, spite, selfishness, and so forth. It is these workers, the majority, capable and devoted, who are the greatest helpers in hygiene. They are the greatest in the sense that the private soldier, to whom Lord Haig paid tribute, is the greatest fighter. But for their numbers, skill, energy, patience, staunchness and devotion to duty, there would be another tale to tell from that which is told in the columns and obituary notices of the newspapers, in the medical press and in the reports of the Health Ministry and of the Registrar-General. The commander-in-chief and his staff may plan a campaign. They cannot win it save through the deeds of the rank and file.

What are these deeds in the health campaign? It would take a long time to enumerate them in full, but from what has already been said you have no doubt gathered, if you knew it not previously, that they fall into two chief groups which we may conveniently term environmental and personal. The former are those which the pioneers in this country chiefly practised when they fought and won under the war-cry, *Sanitas, sanitatis, omnia sanitas*; the latter embrace the principles which the far-sighted genius of Frank perceived to be essential, and others which he did not visualize, but which have established themselves throughout the fruitful years when the public health pendulum swung from the old order of things to the new.

And here let me remark that, although it cannot be said to have swung too far, for the hygiene of the individual is of paramount importance, yet interest in the new has, I fear, led to some neglect of the old. How otherwise can one explain the filthy condition of some of our streets and highways, the shocking manner in which much of our food is handled, the refuse dumps one encounters in rural areas, foul blots upon fair scenes? It is true protests are raised, but the faults continue, while one can imagine that in earlier days, say about 1860, the fervour of the reformers would have swept them away. Let us strive to preserve a balance and, in pursuit of new triumphs, not permit that insidious enemy, dirt, to regain positions from which he has been ousted. Even when dirt does not spell disease it leads to a lowering of tone, to a lack of self-respect, to a slackening of fibre. The trouble is partly due to the fact that much of the sanitation which formerly very closely concerned the medical officer of health has been relegated to other control. In the earlier days he had to fight like

the devil, or shall we say like a good angel, to secure pure and sufficient water supplies, to get sewerage systems established, to ensure the healthiness of dwellings. Nowadays, for order has long since succeeded chaos, water supplies, sewerage and sewage works, house drainage, and so forth, are in the hands of competent engineers. Minor engineering and house sanitation is looked after by well-trained and certificated sanitary inspectors.

Good and well, but from what I hear and what I see, I believe it would be an advantage if our medical officers of health had a little more time to keep in personal touch with these matters. This, I believe, is even more true in the case of the removal of nuisances and of refuse, one of the chief environmental duties in the olden days, and still in tropical countries a most essential part of the health officer's routine.

As of yore, the other environmental deeds comprise action relating to housing and town-planning, smoke prevention, the inspection of food, the control of infectious diseases and inquiries into offensive trades. I cannot list them all, but, with the exception of the control of infectious diseases, they have slipped a little into the background, for a multitude of activities relating to the hygiene of the individual now falls to the lot of the medical officer of health and certain of his assistants. In the matter of practical application these new duties are a product of this century, and comprise maternity and child welfare work, the special and intensive control of tuberculosis and the venereal diseases from the standpoint of the infected individual, the care of the health of the school child, the care of the blind, and occasional duties arising out of the National Insurance Act.

Formerly the great idea was to stamp out disease, especially communicable disease. That great idea persists, but along with it there is now the conception of rearing a sound and healthy race from the start, of extending the campaign to diseases called non-communicable, like rheumatism, rickets and cancer, and even to minor maladies such as dental caries, oral sepsis, discharging ears, habitual constipation, the common but crippling cold, and the dyspepsias which cause so much chronic ill-health and lead to so much inefficiency. There is a move also towards investigating and dealing with worm infestations, which in the past have been somewhat neglected.

Public education in hygiene has become a feature of the new campaign, and you have just had evidence of this development in the Health Week which you have been celebrating.

Enough has been said to indicate that hygiene in this country must now be spelt with a very large H, and it must be evident that the health organization is complicated, as indeed it could scarcely fail to be considering its origin, the way it developed, the fact that over a long period of years there have been shifts and adaptations and modifications, the manner in which new legislation has been grafted upon old, the necessity for conforming to altered conditions of life.

Some of the helpers have been mentioned, but there are many others.

The school teacher inculcating simple rules of health helps the cause, so does the wise parent, so does the child who puts precepts into practice. The schools of medicine help, and will help more when they adopt as the chief object of their training the permeation of the medical curriculum with the preventive idea. Specialist medical officers help, like those in charge of tuberculosis and venereal disease clinics. In this category comes also the school medical officer and, despite all that is urged against him and his doings, the public vaccinator. The medical practitioner helps, and his help will increase in value when he co-operates to a greater extent than at present with the officers of the public health service, and if and when the idea of periodical health examinations takes root. The medical press helps, and it is gratifying to note how much attention it now pays to the preventive side of medicine. Veterinarians help by dealing with tuberculous milch cows, and stamping out diseases of animals transmissible to man. Employers of labour help when they make provision for the welfare of their staffs and employees. The tradesman helps when by his cleanly methods he handles human food in a way to command respect and confidence. I always take my hat off to the maiden in the sweetstuff shop who uses a scoop instead of her hand, be the latter never so dainty.

Those engaged in research help, as, for instance, the great army of workers under the ægis of the Medical Research Council and those engaged in many scientific institutions upon problems affecting every branch of hygiene. There are many voluntary agencies, like the League of Red Cross Societies, which help, some more wisely than others, but all in some degree so that we recall an old proverb of Portugal which says: "One grain fills not a sack but helps his fellow." The lay press helps, often very greatly; occasionally, perhaps, not to the best advantage, but with opportunities vouchsafed to few of those who aid the cause. Its influence in the past has been widespread, and in the future will become more effective when those best fitted to advise the public can make use of its columns for propaganda purposes. The Church helps in various ways, and might help more if it recognized to a greater extent that sick bodies are specially apt to be tenanted by sick souls, and that there is something to be said for giving bodily and mental hygiene a first innings in any attempt to elevate the masses and improve moral tone. The Law helps, though it is better not to invoke its aid and to try what persuasion and education can do in the first instance.

But the lesson to-day, the lesson your Health Week has been inculcating, is that everyone can help. There is no mystery about the business. Once a few essential facts are mastered, simple rules of health can be adopted and practised by any person of average intelligence. A vast deal of public health practice is common sense applied to everyday affairs. Long ago it was different. A pall of ignorance shrouded the medical faculty and the laity alike. Visitations of disease were supposed to be the outpoured vials of wrath of an outraged deity. Superstition was

rampant. Fatalism held sway. The people perished for lack of knowledge. Now all is changed, and, though we are still ignorant in certain directions, for example, the causes of influenza, measles and the so-called "sleepy sickness" still elude us, we have a firm grasp of principles and in large measure are masters of our fate. Who can doubt it? Consider what has happened.

The death-rate of the whole country has fallen to a figure which fifty years ago would have been regarded by many as beyond the dreams of the most optimistic. The infantile mortality has been halved in the course of a generation, the tuberculosis death-rate has steadily declined: some diseases have become extinct, others nearly so. The expectation of life, that is, the number of years a person may expect to live from the time of birth, has greatly increased, i.e., from about forty-five in 1900 to fifty-five to-day. In the U.S.A. it is fifty-eight, in New Zealand sixty-two. In British India, a land where hygiene has as yet made little progress, it is only twenty-three. What we now have to fight is not so much death as damage. Life has not only become safer but infinitely more comfortable, though there is still great need for improvement.

The facts are convincing, but these kinds of fact do not always appeal to the multitude, and, in any case, there are many people who, quite rightly, always consider the cost, their motto being, "Is the game worth the candle?" and their candle meaning hard cash. Not only so, but perhaps because there was some truth in Napoleon's sneer about a nation of shopkeepers, not a few folk in Great Britain and, I take it, the Isle of Man, want return for their outlay, if not actually in what used to be called "jingling Geordies," at least in *terms* of guineas or of pounds, shillings and pence.

Both classes may rest satisfied, for it is well worth while spending money on health, which is in a high degree a purchasable product, and, moreover, hygiene pays. It is a good and sound investment both for the individual and for the nation. If, after your Health Week, any sceptics remain, they will naturally say, " Submit your proofs, and in plain language which can be understood, not camouflaged by scientific verbiage or rendered unintelligible by the use of what the Scotch call 'lang-nebbit words.'" Well, here they are—a few of them—there is not time for many, though they could easily be multiplied.

First, let us consider the monetary value of human life. What is that enigma, a human being, worth in coin of the realm? Well, his or her value varies according to age. The latest calculations come from America and are, of course, not applicable to this country, especially as they are based on earning capacity. However, it is interesting to consider them. Dublin and Lotka have recently shown that in 1924 the potential value of a male child at birth was no less than £1,866, and, what is more, they have demonstrated that since 1901 its value has increased by £356, or nearly twenty per cent, owing to improved conditions.

Woods and Metzger have shown that in 1927 the average *per capita* value of the population of the United States was £3,113. There have been more or less vague guesses on the subject this side of the Atlantic, and one feels that Dr. Nankivell, the Medical Officer of Health of Plymouth, was distinctly cautious when he said : " It is not an exaggeration to suppose that a life is worth on an average at least £100 to the community." Working on this modest basis and comparing the Plymouth of to-day with that of seventy years ago, he concludes that the improved health of the city represents a large annual financial saving which for 1926 he estimates at £100,000. " Nothing," he says, " costs the individual ratepayer more than sickness and mortality."

There you have a calculation concerned with all kinds of preventable disease. Let us look at another limited to a single malady, but a malady which takes heavy toll and which is one of the " four scourges " to which Dr. Fremantle devotes a chapter in his interesting book, "The Health of the Nation."

The malady is syphilis, that " hidden hand in pathology," as it has been called, and Colonel Harrison, writing about it in England and Wales, points out that " in 1920 there were reported to the clinics about 42,000 cases. Of these probably 6,000 would have died of some sequel of syphilis had it not been for the treatment afforded by the free clinics." He assumes that the value of a man's life is £60, which he admits is a very low figure considering that the deaths would have occurred in persons at the most productive period of life. As a matter of fact, £500 would have been nearer the mark, and, as we have seen, in the United States an infinitely larger figure would be quoted. However, if we put it at £60, the loss would have been £360,000 by 1927. This represents only the saving of life. The average patient prior to death is ill for about three years. Hence the system of free treatment, a great ally of hygiene, by which many thousands of people are prevented from becoming burdens on the community at a time of life when they should be national assets must be of immense value to the nation.

Take another disease—small-pox—which in a mild form we now permit to run riot in certain parts of England. Dr. D. Rocyn-Jones, the County Medical Officer of Monmouthshire, estimated that the recent small-pox outbreak there had cost the ratepayers £10,000 in capital expenditure and equipment, while the maintenance of 200 beds for six months means another £13,000. That is a pretty state of things brought about by the neglect of a measure, the value of which in preventing small-pox has been abundantly proved and proved up to the hilt.

Sickness in relation to its cost in industry formed the title of an interesting paper by G. F. McArthur, the chief Lady Welfare Superintendent of the London Midland and Scottish Railway Company. She quotes statistics issued by the Ministry of Health to show that, in 1926, there were 15,000,000 cases of individual sickness drawing benefits under

the National Health Insurance Act, and that 27,000,000 weeks of working time were lost owing to illness, much of it, remember, if not most of it, preventable. The loss of wages to the workers is estimated roughly at a minimum of £30,000,000, and this means a corresponding loss to the nation in spending power. There remains the loss to production faintly reflected, as she puts it, in the 27,000,000 weeks of lost working time. Approximate though they admittedly are, these figures are probably under than above the mark, and they should give one furiously to think. It must be clear that money spent in diminishing this drain is money well spent, and, as a matter of fact, a comparatively small expenditure will bring about a great reward and in two directions. As McArthur well says: "If every industry would examine its sickness cost with the same thoroughness as it examines its manufacturing costs, and with the same motive of reduction, the result would not only be to bring down the premium of the health insurance societies, but to bring 'peace in industry' many milestones nearer its longed-for fulfilment."

Professor Collis, quoted by Dr. Deardon, is even more emphatic on the "savings" question. He considers that medical science properly applied to British industry would result in an annual saving in labour turnover of from 60,000,000 to 70,000,000 sterling, in lost time of 50,000,000 to 60,000,000, in industrial convalescence of many millions more, and that to assess the total saving at £140,000,000 a year would be quite reasonable and well within the range of possibilities.

Lastly, for figures are apt to become wearisome, let me refer to an act of great significance. Insurance companies know the value of money and are careful about their investments. The American has never been accused of lack of appreciation of the dollar. Yet we find an American company, the Metropolitan Life Insurance, generously supporting public health work in Canada and the United States. Why? Because it is good business.

There is another aspect to this financial question which strengthens the argument that hygienic measures pay. In the absence of adequate preventive measures employers of labour may have to compensate their workpeople. Not very long ago, the widow of a coal-miner in Scotland obtained compensation because it was shown that her husband had died of a disease called infectious jaundice, and that he had become infected in the pit from a rat or rats harbouring the parasite of that disease.

With all these facts and figures before us, what are the investments which can safely be recommended to the inhabitants of this island? From a study of statistics and from information kindly supplied, it is clear that anti-tuberculosis gilt-edged stock, if it can be secured, would yield good returns. Well, it can be got if, at the same time, you take some ordinary temperance, I don't say teetotal, shares, and secure also some housing debentures. I call these debentures because money put into good houses and devoted to lessening overcrowding may well result in a repayment of principal in addition to interest.

Segregation cumulative preference shares may be commended. In other words, put money into an hospital where cases of communicable disease can be received and the danger of spread of infection thereby lessened. You may see little or no result one year, but the time will come when this investment will prove a boon and a blessing.

Milk bonds are indicated, for there is much need for the consumption of more milk, and such milk should be pure and cheap.

Douglas has already put money into what we may call ordinary water shares with the ordinary result, which at one time would have been looked upon as extraordinary, that typhoid fever has been abolished in the town. It still, however, lingers in the other districts, and so anti-typhoid stock is indicated for purchase. It is, as has been hinted, of different kinds.

Finally, funds may well be devoted to obtaining education trustee securities, another gilt-edged stock. Making yourselves trustees for public health propaganda, you can put money into this type of investment without being liable for depreciation. In any case, there should be no depreciation, nor should any of these ventures fail. The Isle of Man is favoured in many ways. It is comparatively isolated during part of the year, and isolation in health matters has its advantages. Its climate has much to commend it. It enjoys a fair measure of prosperity, and yet is free from the graver industrial problems. It is interested economically in keeping healthy, for it derives much of its revenue from its visitors, and typhoid and tourists are incompatible.

Its death-rate, 14·6 per 1,000 in 1926, is a fairly respectable figure, and is less than its birth-rate. Its infant mortality rate is not very high and is improving. Altogether it would appear as if the Isle of Man, starting, it is hoped, on a new race for health, has an excellent handicap. There really seems no reason why it should not achieve a record. It would be a proud boast in years to come if this little island could wrest the laurel wreath from another island, from New Zealand, which has already achieved several records and is all out to make others. It is worth trying, for everyone benefits in the process, except perhaps undertakers, sextons, and the proprietors of cemeteries and crematoria, and, after all, these good folk can never be quite ruined, for all must, in the long run, die. The great thing, however, is to die as we are meant to die, peacefully at a good old age, and to live as we are meant to live, healthily with sound minds in sound bodies.

You may have heard of the old parson in the Clyde estuary, who was wont to pray for the greater and the lesser Cumbraes and the adjacent islands of Great Britain and Ireland. Let us pray that the people of the Isle of Man and of its adjacent islands will devote themselves more and more seriously to the pursuit of health and the prevention of damage and of disease, remembering the stirring words of a great poet :—

> "Men, my brothers, men the workers, ever reaping something new:
> That which they have done but earnest of the things that they shall do."

FIGHTING SMALL-POX.

By FRANK S. HILL, ex-Staff-Serjeant,
Royal Army Medical Corps.

The last time that small-pox assumed large epidemic proportions in this country was at the beginning of the twentieth century, but thanks to the efforts of sanitary authorities and their staffs it was, in large measure, controlled. After several years quiescence there has been a recrudescence of the disease, which in many cases has appeared in a considerably modified form known as alastrim. At times, however, it reappears in its earlier virulent form; while in addition there is the possibility of cases of the severe type, or infection from them, being imported from abroad.

In the light of past experience, the procedure adopted in combating the disease has been regularized to a large degree, and, despite all criticisms and arguments to the contrary, confidence in the protective value of vaccination remains unshaken among doctors, nurses, sanitary inspectors, disinfectors and all public health officials whose duties bring them into contact with the sufferers.

There are many authorities concerned in combating the disease or in preventing its importation, i.e., Ministry of Health (the General Staff of the Public Health Service); port sanitary authorities with their port medical and other officers; the medical officers of health and other public health officials of counties, county and other boroughs and urban districts.

The scheme of defence and attack includes the following:—

(1) Speedy removal of patients to isolation hospitals.

(2) Prompt disinfection of infected rooms, etc., and disinfection or destruction of articles associated with the patients.

(3) Vaccination or revaccination of "contacts."

(4) Communication of full information of the occurrences of cases, together with lists of "contacts" to medical officers of other districts concerned.

(5) Information of the occurrence of cases to medical practitioners in the district affected.

(6) Notices to the general public of the existence of small-pox in the district, emphasizing the protective value of vaccination.

(7) Co-operation with the Poor Law Guardians (who still are the vaccination authority) in the matter of the provision, in times of epidemic, of temporary additional vaccination stations, or in smaller outbreaks an extension of the hours when the public vaccinators are available.

The first and most important matter is accurate diagnosis, since failure to recognize small-pox may have very far-reaching effects. After a period of years without the occurrence of cases, which may result in many doctors never having seen a case of this disease, it is possible that they may be in doubt, especially as there are certain other diseases where the symptoms

may be confused with small-pox, such as chicken-pox, scarlet fever or measles. In order to assist medical practitioners in this matter, it is usual for arrangements to be made by the authorities so that the services of the medical officer of health and specialists of consultant status may be available. A medical practitioner is thus enabled to secure a second opinion in any case presenting difficulty of diagnosis. In addition to this, certain of the medical staff of the Ministry of Health are ready to assist in cases of special importance. All definite cases must be immediately reported to the Ministry of Health, since in these days of rapid transit infection may be spread over a wide area in a very short space of time.

The telephone service is of great assistance in dealing with small-pox, since valuable time is saved by its use. In any well-organized public health department, if a doctor has asked the medical officer of health or the county small-pox specialist to see a doubtful case, the hospital authority is advised forthwith, and the ambulance and the disinfecting staff with their motor disinfecting van are standing by. Thus it is possible, directly a positive diagnosis is made, for the patient to be removed promptly, the infected premises thoroughly disinfected, and textile contents of the infected room and patient's clothing removed for disinfection, or, better still, for destruction. It has been the custom in many districts, if the case is one of the hæmorrhagic type, to destroy the bedding, clothing, etc., and to make compensation for the loss sustained. Those who have seen bad cases of this type of the disease will agree as to the wisdom of this course of action.

On the question of disinfection, it will be found advisable to arrange for the laundry van to deliver only washed articles at the house from which a case has been removed, and for it to call at the Council's disinfecting station for the soiled week's wash which will have been previously collected from the house and thoroughly disinfected. This should be done for a fortnight after the removal of the patient.

It is of considerable assistance to the medical officer of health when practitioners in such cases either request "contacts" not to leave the house until they have been vaccinated, or else obtain the addresses to which they are proceeding and inform the medical officer of health. Tracing and vaccinating all "contacts" is of supreme importance if the disease is to be held in check. It is customary to keep them under supervision, especially those foolish ones who refuse to be vaccinated, for fourteen days. Well-organized public health departments will obtain the full list of contacts within a few hours of the diagnosis of the case and send information concerning them, or of the patient's personal movements during the preceding fortnight, to other districts concerned. This is done by telephoning the information forthwith upon its receipt and confirming the message by letter. Similarly, by means of a "circular" letter, every doctor practising in the district is advised by post the same day of the occurrence of a case, and is given any special information appertaining to it. This communication is of especial importance at the commencement of an outbreak, and

may be of considerable help to doctors in their inquiries concerning the movements and associations of their patients who may be suffering then or at a later date from suspicious symptoms.

If the medical officer of health is of opinion that, from the type of the disease, the locality of the premises, the patient's occupation and other important factors, there is a possibility of the disease assuming epidemic proportions, he will probably issue handbills to the public through the medium of clinics, welfare centres, schools, public libraries, etc., also placarding the district with posters. These handbills and posters, which are kept in stock ready for use, are usually couched in the following terms :—

"SMALL-POX.

"The occurrence of SMALL-POX makes it very advisable that every person should be vaccinated or revaccinated.

"In the opinion of the highest medical authorities, vaccination is a perfectly safe procedure and is the greatest protection we have against small-pox.

"Unvaccinated persons are highly susceptible to small-pox: revaccinated people are practically immune.

"Any persons wishing to be vaccinated should consult their own private doctor without delay ; or vaccination will be performed free of cost by the Public Vaccinators whose names and addresses are as follows :—"

As the Poor Law Guardians control the vaccination officers and public vaccinators and will do so until the Poor Law is incorporated with the Municipal Service, it is necessary for them to be notified whenever small-pox occurs. Here again it is best to notify each and all at once, and not merely to be content to send an official communication to the "Clerk of the Guardians."

The offices of the Public Health Department in such times of stress are usually open after normal hours, and officers remain on duty at week ends. In addition, sanitary authorities put their medical officer of health on the telephone at his private residence, so that he is available to medical practitioners and can receive urgent messages from the caretaker at the public offices at any time. Experience has shown that promptness of action is of great importance, and this is realized in all efficient health departments, where work and travelling in connexion with small-pox is performed as rapidly as possible and is accorded priority over all ordinary departmental work.

It is possible, however, for the best laid plans of the medical officer of health to go astray, as may be instanced by the two following incidents. At the beginning of the last epidemic, a case occurred—the first in the district for very many years. Immediately the "alarm" was sounded this district, which prides itself on its high standard of efficiency, promptly took action and all possible steps were taken to deal with the outbreak.

Unknown to the medical officer of health, however, a handy-man in the municipal depot, seeing the disinfectors hard at work and clearing out all material in hand (for articles not infected with small-pox are always treated separately and cleared away), voluntarily "lent a hand," and by so doing came into contact with the infected articles. All the staff of the medical officer of health's department had been vaccinated, but this "handy-man," in common with too many of the general public, was unprotected. Of this no report was made; the disinfectors alone knowing that he had

DAY		
1	Exposure to infection	12 days, incubation period. Patient not infectious, and apparently in good health
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		2 days, invasion. Patient probably not infectious if skin unblemished
14		
15		2 days, papular rash
16		
17		2 days, vesicular rash
18		
19		4 days, pustular rash
20		
21		
22		
23		8 days, drying stage
24		
25		
26		
27		
28		
29		
30		

had anything to do with the infected clothing, bedding, &c. It came as "a bolt from the blue" when in due time this man went down, and the truth came out. Despite all explanations, the indisputable fact remained that an employee of the sanitary authority, who was unprotected by vaccination, had caught small-pox while assisting with the disinfection of infected articles.

In another instance, a case was notified from a tenement house, and here again considerable pains were taken to ensure that every person liable to have come into contact with the patient should be vaccinated. Apparently every one was accounted for, and the sanitary staff congratulated themselves on having successfully secured the vaccination of all concerned.

In due course, however, the landlady of another tenement house in an adjoining street complained to the medical officer of health that a young man who had taken one of her furnished basement rooms at the time of the occurrence of the first case had been ill in bed, unattended, for a few days, and that she "did not like the look of him." Upon investigation, the medical officer of health found that the young man was a member of the family first affected and, on account of his opposition to vaccination, immediately the first case was diagnosed and vaccination for all "contacts" was proposed, had removed from his home and persuaded the other members of the family to keep silence concerning him.

Such circumstances as these thwart the energies and endeavours of the most painstaking and careful officers, who, too often, while fighting small-pox are never praised when their efforts are successful by those who would be only too ready to blame them should they fail in their endeavours to control the disease.

Of all the ills to which mankind is heir, this is at least one that can be almost certainly avoided; and it is most regrettable that the want of knowledge of the toll levied by this most loathsome disease should have lulled the public into a false sense of security and led so many of them to ignore the protection afforded by such a relatively simple matter as vaccination.

The preceding table may be interesting to those concerned in fighting small-pox; it has been found to represent the general run of the average case, assuming that exposure to infection takes place on day No. 1.

The decline in vaccination that has been in progress for many years has resulted in a large number of the population being unprotected by vaccination, and sooner or later there will be an epidemic on a very large scale. The people, in the exercise of their liberty, have had the right to choose between vaccination and the risk of infection, and they have chosen the latter. The material therefore, is to hand, and at some unexpected time the conflagration will start.

Editorial.

SOME RECENT RESEARCHES ON THE VALUE OF MILK IN THE DIETS OF BOYS DURING SCHOOL AGE.

THE earlier writers on dietetics thought that an adequate diet was one which contained a sufficient intake of protein, fat and carbohydrate, and had the requisite total calories. A study of the chemistry of proteins has made it clear that all proteins are not dietetically equivalent. The body requires to be supplied with all the amino-acids of which its cells are built up, and a protein which contains all these amino-acids is of more value than one in which some of the essential acids are missing. The proteins of milk contain all the essential amino-acids.

Voit, Mellanby and other observers have shown that mineral constituents are important for the growing organism ; the young child requires calcium and phosphates for the building up of bone, and these must be supplied in adequate amounts and definite proportions. Most articles of food are deficient in calcium, but milk is specially rich in this mineral and contains calcium and phosphates in the proper proportion. Voit has calculated the calcium requirement of a growing child at one-third of a gramme a day, which is equivalent to seven ounces of milk.

In 1927 Cramer drew attention to the relation of national health to milk production and milk fat consumption. Milk is rich in vitamin A and also contains a considerable amount of vitamin B, but no vitamin C. Cramer, Macy, Sherman and McLeod have all noticed a tendency to lung disease in animals when fed on diets deficient in vitamin A, and Bloeb, of Copenhagen, in his studies of diets of children, noted a liability to catarrhal infections of the mucous membranes, particularly of the respiratory organs, when the diet was deficient in vitamin A.

The Committee on Nutritional Problems of the American Public Health Association consider that vitamin A is more seriously neglected in our diet than any other vitamin, and lay stress on the increased susceptibility to pulmonary disease which results from its deficiency. They say that milk is the most important of the animal sources of the vitamin. They recommend one quart daily for children, and consider one pint daily is the minimum allowance for an adult.

Recent researches by Corry Mann and Orr emphasize the value of the addition of milk to a diet even though the addition in a quantitative sense seems exceedingly small.

In Corry Mann's studies the addition of one pint of milk a day to a diet which by itself satisfied the appetite of growing boys caused an average annual gain in weight for a boy of from 3·85 pounds to one of 6·98 pounds, and an annual increase in height of 1·84 inches to 2·63 inches. The improvement in nutrition was not due to the relatively small increase in the fuel value of the diet, nor to the extra proteins of the milk, but

rather to some specific qualities of milk as food. It is difficult to decide on what precise factors the striking effect of various additions to the basic diet depends. It may be attributable to the vitamins, but it may be also due to other factors.

There were several groups of boys living in different houses, but similarly housed, who received the same basic diet. House 1 served as a control, the boys receiving only the basic diet. House 2: The boys received the basic diet plus one pint of fresh cow's milk daily—value, 358 calories. The milk was pasteurized at a temperature of 145° F. for thirty minutes, and a half a pint given morning and evening. House 3: The boys received the basic diet plus three ounces cane sugar—value, 350 calories; sugar was used to supply calories rather than to improve the quality of the diet. House 4: The boys received the basic diet plus 1⅓ ounces of best New Zealand grass-fed butter daily—value, 387 calories. The vitamin-content was tested by titration on rats. Houses 5 and 6: The boys received the basic diet plus ½ to ¾ ounce of watercress: the vitamin-content of the watercress was tested on rats as in the case of the butter. House 7: The boys received the basic diet plus ¾ ounce casein daily. House 8: The boys received 1¾ ounces of vegetable margarine consisting of coconut oil and ground nut oil—value, 379 calories; the vitamin A content was tested by titration on rats.

Corry Mann states that the object of his researches was to discover whether an increase in height and weight could be best obtained by giving the boys merely more calories as in the case of sugar, or by adding fat alone or by giving fat with vitamin or giving vitamin alone. Whether, again, an improvement in the biological value of the protein in the diet might not perhaps be more necessary than any other change in the basic diet, and for this reason a ration of edible casein was chosen, which practically doubled the amount of animal protein in the basic diet.

The colony of boys was housed in a model village consisting of nineteen cottages, each cottage being of one storey and having accommodation for thirty to forty boys of school age. The boys were examined and rated A 1 to B 3, and as far as possible an equal number of the same age and rating was consigned to each house. The range and weight of the boys was also narrowed down to a limit of thirty-five to fifty pounds, and some of them were observed for two years.

In the basic diet the average number of calories daily varied from 1,679 to 2,154. The average ration of protein from both animal and vegetable sources was found to measure between 56·13 grammes and 71·64 grammes daily; of this total an average of 13·9 grammes to 21·12 grammes daily represented animal protein only.

The average daily values were: Protein, 63 grammes or 13 per cent of calories; fat, 38 grammes or 18 per cent of calories; carbohydrate, 318 grammes or 68 per cent of calories. The amount of fat in the diet,

though of adequate calorie value, is small; the average amount contributes only 18 per cent of the total calories in the diet. In one of good quality the fat would account for 30 to 35 per cent of the total calories. The carbohydrate which forms 68 per cent of the total calories is in excess and the diet is badly balanced for that reason. The basic diet may be compared with a good average diet.

Percentage of total calories :—

Basic diet: Protein, 13; fat, 18; carbohydrate, 68.

Good average diet: Protein, 15; fat, 35; carbohydrate, 50.

Fifty-one boys were under observation on this basic diet for twelve months, and during that period they gained an average weight of 3·85 pounds per boy, and grew an average of 1·84 inches per boy. These increments show the diet is adequate from a physiological point of view, and the calorie value of the diet per pound of body weight would appear to be adequate when compared with standards which are generally accepted. The average boy received 80·5 calories per kilogramme of body weight. This is the value recommended by Holt and Fales as suitable for children between the ages of six and fifteen years.

As the calorie value of the diet appeared to be adequate, it seemed possible that an improvement in nutrition might be expected with an alteration in the balance and quality of the diet. An average increase of 3·85 pounds per year, between the ages of 6 to 11 years, on the basic diet compares unfavourably with an average increase of 5·5 pounds per year for the same ages which has been found a reliable increment for healthy school children of the industrial class.

A group of forty-one boys fed with an additional ration of cow's milk remained under observation during the twelve months, and during that time gained an average of 6·98 pounds per boy, and grew an average of 2·63 inches per boy. Twenty-three of these boys completed the two years' test, and the average gain remained steady, amounting to 13·17 pounds and 5·2 inches per boy for the two years period.

Analysis of the milk made by the Ministry of Health showed that it contained: Protein, 3·33 per cent, fat, 3·7 per cent, and lactose, 5 per cent. The ration of milk, therefore, contained 18·7 grammes of protein, 21·02 grammes of fat, and 28·40 grammes of carbohydrate, with a calorie value of 388·59. The amount of animal protein and animal fat had been doubled in the basic diet, and with the additional milk the average daily intake was: Protein, 81 grammes or 14·4 per cent of calories, fat, 59 grammes or 23·8 per cent of calories, carbohydrate, 346 grammes or sixty-one per cent of calories. There was a marked improvement in the physical condition of the boys, they lost the tendency to chilblains in the winter months, which was almost invariably present among the boys who were only eating the basic diet. These boys also showed roughness of the skin and tendency to pot-belly, resulting in excess of gas formation in the smaller bowel. These features were no longer observed after the boys had been taking the milk

ration for a period of eight or nine months. The boys taking the ration were also more high-spirited and irrepressible, and it was possible to recognize the boys who were taking the milk at a glance on account of their obvious physical fitness. Furthermore, during the winter of 1923-24, there was complete absence of illness among the boys on the milk ration, although in the other houses the sickness rate had been somewhat higher than usual.

The results of feeding with an extra ration of sugar did not indicate any marked improvement in the physical condition of the boys. It was hardly expected that the addition of calories rather than an improvement in the quality and balance of the diet would make much difference. Some authorities consider sugar to be of great valne during the active years of school life. With the additional sugar the average daily values for a boy of 52·5 pounds were: Protein 63 grammes, or 11 per cent of calories; fat 38 grammes, or 15 per cent of calories; and carbohydrate 403 grammes, or 73 per cent of calories. A group of twenty boys remained under observation during twelve months, and during that period gained an average of 4·93 pounds per boy and grew an average of 1·94 inches per boy. This is a poor result when compared with the effect produced by giving equivalent calories of milk as an additional ration.

In order to study the effects of adding butter to the ration it was decided to employ the best quality of grass-fed butter from New Zealand which would not change during different seasons of the year and carried a guarantee of the Government of the Dominions. The ration was one and three quarter ounces and the average value, 387·81 calories, was isodynamic with the ration of milk which was used for the other group of boys. The vitamin content of the butter was tested by Dr. Coward, who reported that it had a very high value of vitamin A. With the additional butter the average daily values were: Protein, 63 grammes; fat, 79·7 grammes; carbohydrates, 318 grammes. The diet now compared favourably with a good average diet, though the percentage of protein was rather low. When taking the basic diet the boy of average weight, 52 pounds, took 1·59 grammes of fat per kilogramme of body weight, but with the additional butter ration he received 3·3 grammes of fat per kilogramme of body weight. Holt and Fales found that the average intake of fat between five and eleven years for boys varied from 3·2 to 3·5 grammes per kilogramme of body weight. The group of twenty-six boys took the butter ration for twelve months, and during that time gained an average of 6·3 pounds per boy and grew an average of 2·22 inches per boy. The general health of the boys improved quite definitely, the skin becoming softer, and during the winter months there was less tendency to chilblains than was found among the boys on the basic diet group.

For the feeding experiment with an additional ration of margarine, a brand was selected which contained no butter fat. The ration was 1·34 ounces and the energy value 379·62 calories. The vitamin value was

estimated by Dr. Coward, who reported that the margarine was deficient in vitamin A. With the additional margarine the average daily values were: Protein, 63 grammes; fat, 78·8 grammes; carbohydrates, 318 grammes. Sixteen boys were under observation for twelve months, and during that period gained an average of 5·21 pounds per boy, and grew an average of 1·84 inches per boy. The group of boys who ate this ration did not grow in height any faster than the batch of boys who were only taking the basic diet, but the margarine group had an advantage in weight increment.

In order to test the effects produced by increasing the amount of animal protein in the basic diet, thirty boys were fed for twelve months with a ration of edible casein, which supplied 10·03 grammes of protein daily, in addition to that in the basic diet. This ration practically doubled the amount of animal protein in the basic diet, the daily values being: Protein, 79 grammes; fat, 39 grammes; carbohydrate, 318 grammes, showing an increase in animal protein of 17·51 to 33·54 grammes daily. This group of boys gained an average of 4·01 pounds per boy, and grew an average of 1·76 inches per boy. Very little effect was produced by the considerable alteration in the quality of the protein in the basic diet. The general condition of the boys did not improve; the condition of the skin was unaltered, and there was the same liability to chilblains as was observed among the boys in the basic diet group.

The feeding with an additional ration of watercress was done in order to test an item of food which would provide vitamin A. A constant supply from the same firm was maintained for eighteen months, and the average ration was three quarters of an ounce. Dr. Coward tested the vitamin A value of the watercress and reported that it was a high one. The group of twenty-six boys taking the watercress was under observation for twelve months, and during that time gained an average of 5·42 pounds per boy and grew an average of 1·70 inches per boy as compared with the boys under the basic diet. There was a definite increase in weight, and in addition there was some improvement in the condition of the skin and in the general physical condition, though the increase in the calorie value was negligible. This diet was continued for another six months, making eighteen months in all, but at the end of this period there was no increase in the growth rate, although the weight increment was sustained.

As the diet remained unchanged throughout the years of observation, comparison of the results obtained during the winter and summer months respectively was made for three groups: (1) Basic diet; (2) full milk diet; (3) full butter diet. For all three groups there was almost invariably more growth during the summer period than the winter, and the weight increment was usually more marked during the summer months.

Orr, in the preliminary report on the influence of the amount of milk consumption on the rate of growth of school children, gives the results of a large-scale test carried out in 1926-27 in schools in seven cities and towns in Scotland. The test was carried out to determine whether the results

obtained by Corry Mann under the rather special conditions of an institutional school would be obtained in children attending elementary schools and receiving the average and unchanging diet of the ordinary working-class household. At each centre four groups of children were taken, each group numbering from forty to fifty, according to the sizes of the classes in the school. Group 1 received whole milk; Group 2, separated milk; Group 3, biscuit of the same energy-yielding value as the separated milk; Group 4 acted as a control, receiving no supplementary feeding. Children under the test were at the beginning, middle, and the end of school life: 5 to 6-year-old children received three quarters of a pint of milk per school day; 8 to 9 years, one pint; and 13 to 14, one and a quarter pints. Milk was given at school. Children had to be weighed in indoor clothing without shoes, and there were considerable fluctuations noted in the weight figures, even among those taken on successive days. The average weight of clothing was ascertained month by month and the necessary corrections were made in the final weight figures. Owing to these circumstances the records of individual weights are not so reliable as the figures showing the increase in height. At every age the increase in height of the whole milk and the separated milk-groups is significantly greater than that of the biscuit or control groups, while the difference in the increase in height between the two milk-groups is insignificant. The figures of the average increase at all ages were arranged into two groups with the following results:—

AVERAGE INCREASE (ALL AGES).

	Milk group	Non-milk group
Average increase in height	1·470 inches	1·212 inches
,, ,, ,, weight	3·617 pounds	2·974 pounds

As the milk given in school was an accessory article of diet, the home consumption of milk in 626 households was determined and the total milk figure for each child ascertained. For the age-groups 5 to 6, 8 to 9, and 13 to 14, the increase in height of those whose milk consumption was over the average was 1·58 inches, 1·37 inches, and 1·51 inches as contrasted with 1·44 inches, 1·19 inches, and 1·21 inches, for those whose total milk consumption was under the average.

The children in different groups at the various centres were examined and clinical observations made. The clinical reports showed that at most of the schools the children who received the milk appeared to be in better condition than those who had received no milk. It was noted that on the whole they had glossier hair and clearer skins and held themselves more erect. Orr concludes that the addition of milk to the diet of school children has been accompanied by a rate of growth, as indicated by an increase in both height and weight, twenty per cent greater than among children not receiving the extra milk. The increase in the rate of growth was associated with an improvement of the general condition of many of the children. Separated milk is of great value for promoting growth. Its nutritive value for children would appear to be underestimated.

Clinical and other Notes.

AN IMPROVISED DISINFECTOR FOR USE IN SMALL HOSPITALS OR UNITS.

By Major T. O. THOMPSON.
Royal Army Medical Corps.

This apparatus is an adaptation of a mule pack portable disinfector, and is devised to be as simple, cheap, and as nearly fool-proof as possible.

The apparatus has been tried and is being introduced into stations in the Meerut district, at those hospitals where a regulation steam disinfector is not provided.

It can readily be improvised from the following materials: Four-gallon petrol drums, kerosene tins, and packing cases from the hospital storekeeper.

The only portions which cannot readily be improvised are the flexible steam pipe, and the two taps for drip feed. It is an adaptation from the old Aldershot box which was a pre-great-war device, and is not a copy of any patented disinfectors.

The oil and water drip feed for firing is very satisfactory and economical, but requires a little understanding at first; it is always less satisfactory if elaborations are introduced.

The disinfector, as shown in the accompanying diagrams, consists of:—

(*a*) A boiler improvised from a four-gallon petrol drum.

(*b*) A fire box and baffle plate made of cresol or oil drums cut up.

(*c*) Two containers for oil and water (half kerosene drums) provided with taps, and a tin channel to feed the fire.

(*d*) A steam pipe.

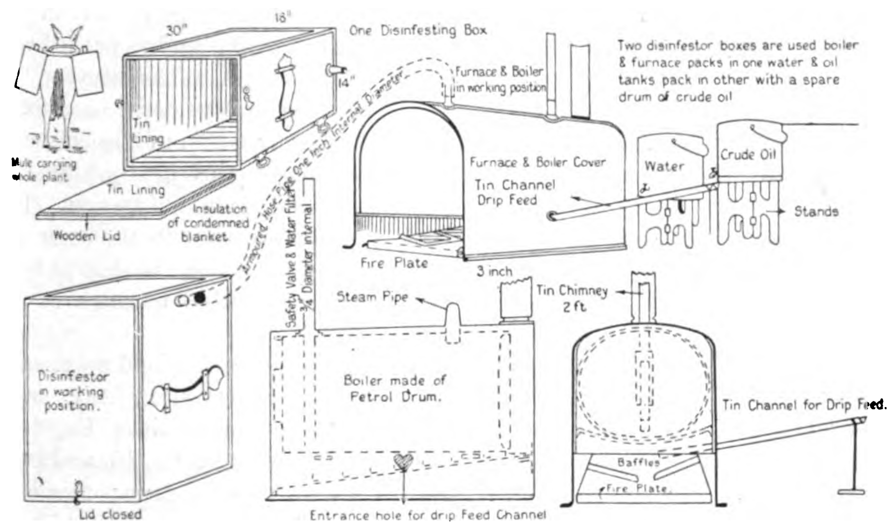
(*e*) One or more steam boxes (packing cases lined with tin, and insulated with condemned blanket).

Detailed Description.

(*a*) The *boiler* is a four-gallon petrol drum with the screw stopper soldered into place. The drum is used in a horizontal position (its seam must be nearer the top than the bottom to avoid the full heat of the fire). Two brass collars are brazed on to the outside of the drum over holes sufficiently large to admit one inch diameter piping. The collars have a thread cut so that two pieces of piping can be screwed home into the drum. One constitutes a filling pipe and a safety valve. Inside it extends to within 1½ inches of the bottom of the drum; outside it should have a height of two or three feet to give sufficient steam pressure. The other pipe merely screws into the top of the boiler with no internal prolongation and constitutes the steam connexion on to which the steam hose-pipe is fitted. The outer,

projecting end may well be filed into a cone so that the hose piping can be tightly jammed on. One inch diameter iron piping will do, but brass piping would be better.

(*b*) *The Fire Box.*—This can be made from cresol drums or any moderately strong sheet-metal of about the same thickness. It is shown below, and as will be seen, is shaped like an arched box with flat ends, one of which reaches to the bottom, the other leaves a gap of two inches for draught. The boiler is held in the arched portion by two sheet-metal straps. The collars of the two pipes in the boiler fit closely to openings in the vertex of the arch, and a chimney made of tin provides the outlet for the fire. The fireplace consists of a metal plate with vertical baffles arranged at three inch intervals. The baffles have a downward inclination



LONGTITUDINAL DIAGRAM OF BOILER & FURNACE

FRONT ELEVATION FURNACE & BOILER

of 15° to retard the flow of oil and water. The plate rests on a shelf at the rear end of the fire box and is raised at the bottom end to allow waste water to drip into a tin. It can be made from the metal-sheeting of a cresol drum. The actual fire is made by a mixed drip of crude oil and water on to this plate.

(*c*) *Oil and Water Containers and Feed.*—These can be made from one cresol drum cut in halves and each fitted with a simple brass tap. (The brass cocks of a Ford car crank case were used in the experimental model.) Handles of wire were made for convenience. Two stands are required also to raise the drums to the required height. The feed is made by a V-shaped tin trough which is supported by a rod at its outer end and passes through the side of the fire-box, and is held by this so that the lower end hangs over the centre of the baffle plate about two-thirds up it.

(*d*) *The Steam-Pipe.*—This should consist of an armoured hose-pipe, one inch internal diameter, about nine feet long. (Six feet will do, but

nine feet makes easier handling.) Canvas hose-pipe may be substituted, but it allows a good deal of steam to escape. It should fit tightly on to the steam pipe from the boiler and also on to the pipe into the steam boxes. A "push" fit is quite sufficient, but a screw union or a sliding ring grip may be used.

(*e*) *The Steam Box.*—For improvised use, any packing case will do quite well. The only point is, it should not be too large, otherwise, when full, it will be too heavy to manipulate. It should be reasonably strong. The packing case is so arranged that one end becomes the opening and the end piece is used as the lid which should be provided with some kind of fasteners. The case has fitted into it a lining of tin (made from kerosene tins); the lid need not necessarily be tin lined but must fit reasonably closely into the box. The tin lining should allow a space of half an inch between lining and wood. This is an insulation space and is packed with condemned blanket, which is best fitted by nailing on to the wood so that the tin lining can be slipped inside it. When the linings have been fitted, a hole is cut right through one side, about two inches from the bottom or closed end. Into this hole is fitted a six- or nine-inch length of one inch diameter metal pipe, kept in position by a screw collar inside and out. This is the steam inlet and the rubber steam-pipe fits on to it in the same way that it was fitted to the boiler pipe. For convenience, the box or boxes should be fitted with handles of leather, or collapsible handles of iron or brass.

(*f*) *Cost.*—Made in the very cheapest and most improvised manner, by an ordinary bazaar mistry, under personal supervision, the whole apparatus with two steam boxes should not cost more than Rs. 35 to Rs. 40. The experimental one made by me cost less than Rs. 15, and works satisfactorily. The expensive item is the armoured hose pipe; this is an essential item, but the cost can be reduced by only having a six-foot length. If the disinfector is made by the M.E.S. the cost will be about Rs. 65 and of course any elaboration, such as brass fittings, &c., will increase the price. It has been especially designed to be as simple to make as possible, so that it can be made by any bazaar mistry, and so that the greater portion of it can be improvised.

(*g*) *Method of Use.*—

(1) The boiler is filled up with water through the filling pipe.

(2) Crude oil is placed in one container and water in the other.

(3) The feed channel and the containers are placed in position so that when the oil and water is turned on, the mixed stream will drip on to the baffle plate.

(4) A piece of rag or paper is smeared with the oil, placed on the baffle plate and lighted.

(5) As soon as it is well alight, the container taps are turned on so that there is considerably more oil than water. Once the fire has begun to get hot, the water can be increased until

the optimun flow of each is found by experiment. When going well there will be a roaring, spluttering, very hot fire and steam is rapidly raised in the boiler.

(6) The articles for disinfection are packed loosely into one steam box, which is stood on its closed end. When full the lid is fastened in position and the whole box inverted to stand on the lid.

(7) The steam hose-pipe is slipped on to the pipe connections of the boiler and steam box.

(8) The steam box rapidly fills with steam by downward displacement and steam can be seen oozing out round the lid.

(9) The lid fastenings are undone, and the box lifted up by the handles and its contents spilled out. If shaken out rapidly, they will readily dry themselves.

(10) While one box is being steamed the other can be packed ready to carry on with.

It is hoped that this short note and description may be of interest and use to those who are called upon to carry out disinfections without any regulation pattern of steam disinfector.

DISPOSAL OF RUBBISH.

By Lieutenant-Colonel M. C. BEATTY.
Royal Army Medical Corps.

The problem of the best means of tackling the collection and disposal of rubbish in urban areas, is an ever-recurring one; each country, and in fact, each town works out its own salvation with a varying degree of success according to the amount of money that is available for the service. Possibly success in this direction may also depend on the interest displayed in the problem by the Medical Officer of Health or on his powers of persuasion with those responsible for loosening the municipal purse strings. It is interesting in wandering around the world to note the diversity in the practice and application of hygienic laws; one country, for some reason best known to itself, will concentrate on one or two principles to the almost total exclusion of others which an onlooker may deem just as important.

A few years ago it was my good fortune to be able to visit a large city on the Pacific seaboard of the U.S.A., and whilst enjoying life as it can be enjoyed on that side of the world, I was struck with the meticulous care taken by the authorities on some hygienic matters, and amazed by the almost total absence of care in others. A few instances will suffice. Hand towels in sealed envelopes are always supplied in public lavatories. Milk in restaurants, by law, must be sold in flasks unsealed in the presence of the

purchaser, and I do not mind admitting that, although this may be a very sound piece of legislation, it has its disadvantages on a hot day when there may be any amount of "loose" milk in a restaurant, and yet not a drop to quench one's thirst: a dry country with a vengeance! The other side of the picture is seen when one meets a municipal dust cart on its rounds heaped up and uncovered. One's nose is assailed by smells, one's eyes and lips assaulted by clouds of dust blown off the cart by the sea breezes for which this city is noted. In addition, all one's Service training is offended by the sight of accumulated waste paper in the gutters along the length of the avenue.

The foregoing is the prelude to an attempt at describing the most up-to-date method of collection of rubbish which I have yet encountered, and which is the perfect antithesis of that mentioned above.

Up to a few months ago, this town (Wiesbaden) indulged in the obnoxious and common method of collection from supposed-to-be-covered, but invariably open, receptacles of all sorts, sizes and shapes. These bins once a week were carried out from their hiding places and placed on the kerb, awaiting arrival of the cart, stumbled over by humans, nosed in by hungry animals and their contents scattered over the pavements. Along came the wagon, and still more was spilled in the act of lifting and turning it in. If wind were blowing, conditions were, of course, tenfold worse. Everyone has met what Topsy no doubt would call this "tubercular experience," so nothing is to be gained by enlarging on it.

The system which has just been inaugurated consists in the provision to each house of a number of zinc-finished metal bins with strong hinged lids, each holding 110 litres and somewhat the shape of a milk churn, and of four 80 h.p. motor rubbish wagons to the municipality. I have, with the German authorities, examined the working of the system in this town and find it very satisfactory; the speed of the operation and absence of dust are very noticeable. Working gangs consist of twelve men, exclusive of drivers, and two wagons. Six men are employed in bringing the bins into the street half an hour before the wagon arrives, four empty the bins, and two carry them back into the houses.

The wagon consists of a cylindric container with a worm inside a metal cylindric cover and has a holding capacity of ten to fifteen cubic metres of rubbish. It is brought into motion by special loading and unloading gears worked by switches from the driver's seat. A hinged steel plate forms part of the back of the wagon, and the bin is lifted and hooked on to this plate. By pressure on the bin the steel plate gives way, the bin lid being still closed, and by a mechanical device difficult to explain in words, the bin is emptied and withdrawn, still with the lid closed. During the whole operation no rubbish or even dust can escape into the street. The back of the wagon opens easily for unloading by means of a special lever on the side. The container is put into reverse and unloads in from two to three minutes.

The main advantage of this system is its dustlessness, and to ensure this the special bins which hold 110 litres and cost about 17s. each are combined with these special wagons, four of which are necessary for this town of about 100,000 population.

In Essen, where the system has been in use for some time, the cost has been worked out and the following figures give a rough idea of the expense:—

8,100 bins are in use, they are empted once weekly.	
Two wagons with drivers, each costing about 90 marks daily ..	= 55,800 marks per annum.
Working gang of 12 men, each 10 marks	= 37,200 ,,
Two men employed at the place of unloading	= 5,580 ,,
Rent for unloading place, etc...	= 11,000 ,,
Interest, keeping bins in order, etc.	= 29,200 ,,
Incidental expenses	= 12,400 ,,
	151,180 marks per annum.

The emptying of one bin weekly therefore costs..	151,180 ÷ 8,100 = 18·67 marks per annum.
Every cubic metre of rubbish	151,180 ÷ 29,000 = 5·22 ,, ,,

Some other advantages of this wagon are:—

(1) Large holding capacity, ten to fifteen cubic metres according to bearing capacity of chassis, therefore greatest economy.

(2) Mechanical loading and unloading without difficulty and as fast as workmen can supply bins for emptying. Tip-up arrangement not required.

(3) Impossibility of overloading and damaging the container.

(4) All sorts of rubbish, even bulky things, can be loaded.

(5) Quick unloading (two to three minutes) without tip-up.

(6) Uncomplicated and strong construction.

(7) Easy cleaning and airing of container.

(8) Loading and unloading at back of cart, therefore, easily reached from either side of the street.

(9) Smart appearance. The whole mechanism and the load lies under cover and is unseen.

Whether the cost of 18s. per annum for the weekly emptying of one bin is excessive or otherwise I am unable to say.

The Essen authorities are convinced that the experience gained in working the system longer will tend to reduce the expense.

In the majority of English towns a thirty to forty h.p. motor chassis would be quite sufficient. In this town, which is very hilly, it is intended to reduce the chassis to sixty h.p.

The ultimate disposal of rubbish varies in different places. The general practice in Germany is dumping in hollows at a distance from the town. In Wiesbaden a large incinerator was built, but during the war this was allowed to become derelict and rubbish is now dumped in a natural hollow two miles away from the residential district. This method is not ideal and the distance from the town and the rental of the land adds considerably to the expense of disposal.

Travel.

KULTUR AND KUR IN A COUPE.

By U. P. A.

(*Continued from p.* 465.)

The "Green Police" are met with in the country, at frontier posts, customs barriers, &c. They seem to act as a county and Republican constabulary. Officers and men are of the finest type, immaculately turned out and obviously saturated in the ways and traditions of the old army. Whereas the municipal police have much in common with our own beloved Robert, the Green Police have "Made in Prussia" stamped all over them: a stern, stiff-necked corps: a first-rate starching material for the German army in its next war.

A couple of weeks could be spent with profit in Nuremberg. But if time presses, and you are in any doubt about where to go and what to see, consult the bookseller Herr Ebel—a cheerful soul, ready to help and full of sound advice.

Travelling via Heroldsberg and Gräfenberg, we entered "Franconian Switzerland" at Pegnitz, on August 4.

As a matter of fact this district does resemble Switzerland—but on a miniature scale: a doll's Helvetia. There are no snows because there is no lofty background; but there are the same variegated types of rock formation and the same kind of hill, forest and valley scenery.

Roads are narrow, winding and steep, and surfaces are bad. Heights vary from 1,000 to 1,600 feet.

There are several fine old rock castles; and a number of curiously-vaulted caves, partly natural and partly hand made.

The day was hot and stuffy, and bloodthirsty horse-flies abounded. On account of these pests we had to lunch in the coupé, closed, and even then Georgina felt nervous.

We debouched from Little Switzerland at Forchheim, a picturesque place with a lovely old rathaus.

The band of a Bavarian rifle regiment arrived to enhance the colour scheme—for a moment, at least; that is, for as long as it took the musicians to scramble out of the motor lorries and disappear in the "ratskeller." Not long!

At the end of 82 miles the coupé landed us in Bamberg, where we stayed for a day.

Bamberg is situated on the Regnitz, on a spur of the Frankish Jura. It contains 49,000 inhabitants; and its history dates back to 902.

In its own way it must be well-nigh unique: it is extraordinary, and delightful too, and has an uncommon history.

Bamberg became a bishopric in 1007, when the building of the cathedral was begun. In 1014 Michaelsberg Abbey was founded and in 1020 Pope Benedict VIII consecrated St. Stephan's Church in the presence of seventy-two bishops.

The old watch tower of Altenberg, high above the town, became the bishops' fortress in 1251. In 1453 the citizens rose in revolt against their prince-bishop Rothenhan; but the privileged soldiers of the church won the day and the townspeople were punished with great severity. However, this did not prevent the Town *v.* Gown feud from breaking out at intervals for over a century.

In 1648 the university was founded, and in 1688-1708 a new bishops' palace was built.

The French occupied Bamberg in 1796 and again in 1800-01.

In 1802 the episcopate was secularized.

In October, 1806, Napoleon, then in occupation of the new palace, declared war on Prussia, and shortly afterwards inflicted heavy defeats on the enemy at Jena and Auerstadt in Thuringia.

In 1815 Marshal Berthier, on seeing the Russian troops enter the town, committed suicide by throwing himself out of a window of the palace.

Bamberg became an archbishopric in 1817.

In 1919 the Bavarian Government and Parliament fled from Munich and at Bamberg set up the new Bavarian-Republican constitution.

Unless something is known of the history of the place, it is impossible to understand the *mise en scène*: a cathedral and dozens of churches, abbeys, monastic houses, pontifical palaces, clerical colleges and residences, and numberless ecclesiastical establishments of every kind: a strong fortress, walls and towers, protected gateways and other evidences of stormy mediæval times: a beautiful rathaus, elaborate Gothic and rococo public buildings and private dwellings, and every sign of a bygone period of luxury, wealth and taste.

Over everything an air of austere opulence created by the militant prince-bishops whose swords, unsheathed, lay in the shadow of The Cross.

The Altenberg, the rathaus, the cathedral of St. Peter and St. George may be mentioned as outstanding features in a town which is, in reality, a museum of high-grade art. The old palace, in particular, is a fascinating collection of buildings.

The Benedictine Abbey of Michaelsberg is also fine; but it is rather a shock to find that its forecourt has been transformed into a popular beer garden. However, we were prepared, for had we not seen a beer saloon occupying part of the interior of the Church of The Holy Cross at Nuremberg?

Fritz often lacks a sense of the fitness of things and his ideas on the subject of sacrilege are certainly not ours. I shall never forget my feelings

of disgust on entering a certain chapel in Belgium, in November, 1918. For several years the Germans had used the building as a Lock Hospital: the usual notices, propaganda posters, special treatment apparatus, &c., were still in situ. It was a horrid sight.

On the day following our arrival in Bamberg we came to an unfortunate decision: we determined to push north through the Thuringian Forest into the Harz Mountains.

The Road to Thüringen.—The road runs through the valley of the Regnitz, a rural district bounded by low hills.

We passed Breiten-Güssbach and the patriarchal schloss at Banz, and, at Staffelstein, climbed a steep and exceedingly bad side road to Vierzehnheiligen, where stands the famous pilgrimage church of The Holy Virgin.

This is a remarkable building. It is situated in a lonely, prominent position, high up on a spur, at the forest's edge.

Everything about the place is indicative of veneration and care; but the effect is marred by a crescent of ramshackle booths for the sale of candles, images, picture post-cards and trash.

At the door of the church is a sternly worded notice to the effect that this is the House of God, and not a museum.

Now, Georgina and I are reverential people. We rather resented this notice; but, on entering the edifice, the reason for the warning was plain. Certainly, this is the House of God. It is also an exhibition of elaborate rococo decoration, a gallery of fine pictures, and a museum of pathology. It is a wonderful, a beautiful, a fearful place. No matter what your spiritual outlook may be, you cannot possibly get away from the flamboyant, the artistic and the morbid.

Coburg is the twin capital, with Gotha, of the Duchy of Saxe-Coburg-Gotha.

In the market-place there is a mediæval rathaus and a statue of the Prince Consort, who was born here, in the Rosenau Palace, in 1819.

The Palais Edinburgh, in the Schloss Platz, was the residence of Alfred, Duke of Edinburgh.

Then there is the Monitzkirche with its lofty tower, the 11th century castle which crowns a commanding eminence overlooking the town, and the ducal palace, Ehrenburg, with its immense and magnificent hall, interesting church and splendid picture gallery.

But although Coburg contains many inspiring reminders of the past, it also contains many factories; and nowadays industry is in the ascendant. The streets were unswept and dirty, thick wreaths of smoke darkened the sky and lowering rainclouds threatened to discharge their contents at any moment.

The air and atmosphere of Accrington.

In a downpour of rain the coupé wended its way through a region of small factories, coal stacks and railway lines.

Coburg provided the Prince Consort with materials for the more serious forms of study; but the Prince's outlook was not bounded by the horizons of his native place. The germ of the Crystal Palace is not to be found here.

The road was vile but the scenery attractive. Gradually ascending, we cleared Neustadt and saw ahead the great Thuringian Forest, surmounted by heavy banks of cloud. By this time the rain had ceased and the sun was shining. The great, dark stretch of trees rising into the heavy clouds made an impressive picture.

A final stiff climb took us into Sonneberg, 50 miles from Bamberg.

More rain. From the hotel we watched it falling dismally, steadily and heavily in the streets, on the hills, and away up and over the dark, gloomy forest.

Meanwhile, Sonneberg was trying to diagnose trouble, which had been located in the magneto.

The mechanics drew sparks from every part of the coupé which lives below its bonnet; and, to make quite sure, "shocked" all their relations, friends and clients as they trooped in to see what all the fuss was about.

The different ways in which the shocks were borne by these innocents was a source of great amusement and delight to the assembled multitude.

Sonneberg's automobilists, amateur and professional, offered help and advice and stood by for hours by way of encouragement: a most sympathetic crowd. And yet the wheels refused to move.

We went to bed.

It rained all night.

It rained all next day.

It rained all the following night, and on the morning of August 8 it was raining harder than ever. At 11 a.m. we held a council of war with the landlord, the porter and the head waiter.

Georgina said: "Your hotel is comfortable and the food is good, but we can't stay here for ever. We want to go through the forests of Thuringia into the Harz Mountains. When will this deluge cease?"

Herr Kurg answered: "In these parts, in August, the rain never stops, the sun never shines, the roads disappear in mud and travelling by auto is impossible."

The porter and the head waiter nodded their heads in confirmation.

"Then," said I, "thank goodness the magneto gave out. Let's be off to the south again, and quickly."

In the meantime the defect in the magneto—a crack in the vulcanite "pick-up" brush—had been diagnosed and treated carefully and well: cured in fact.

The garage owner was a pathetic individual.

He had been blinded in the war and was unaware that the injury was permanent. As a result he was impatient to a degree and had lost control of his temper as well as of his sight, poor man. He shouted and stormed at his staff for their delay in putting the coupé to rights; and, as his voice

was of the brazen order, a visit to the workshop was an alarming experience. However, he was quite polite to, and quiet with, us. When we left we shook hands with him, thanked him for his attention and work, and hoped he would soon recover his sight. He was very touched: almost overcome by gratitude and emotion.

The sudden onset of blindness often does produce curious temperamental changes, of which emotionalism is one.

Before leaving Sonneberg mention must be made of the town's big industry, toy-making.

On Saturday afternoon Herr A. Luge took us over his wholesale showrooms. Thousands of beautifully made toys of every kind, arranged in all sorts of sections—human, animal, by markets, by prices, by festivals, British, American, Chinese, African, by colours, by sounds, by types of mechanism, steam, air, electrical—till, at the end of a couple of hours, I was aged 10, Georgina was feeding a Dutch doll with milk from a hygienic bottle, and Herr Luge was making six different donkeys bray in six different cadenzas.

Do not bother about monkey gland: go to Sonneberg on a rainy day.

South!—We set out at noon, in a deluge.

The roads were small rivers and the forest had disappeared in the heavy rain clouds.

It was as dismal, damp and cold as the Trossachs on a wet day in March, but the sense of speeding once more towards the sunny south kept up our spirits.

The car splashed along through cascades of mud, Georgina shivered and smiled, and I blessed the snugness of the coupé. In weather such as this a "tourer" soon becomes a sieve.

Passing through Neuhaus and Hasslach, we halted at a wayside gasthaus and lunched on sausage, brown bread and beer. The landlord, an old soldier, thought we were hardy campaigners.

Kronach was *en fête*: decked with bunting and crowded with country-folk in holiday attire. The occasion was a "Schützenfest"—a shooting carnival. The numerous marksmen wore a sort of hunting garb, but the colour and gaiety were subdued by the incessant downpour.

Via Zettleitz and the valley of the Main we reached the quaint little town of Culmbach, where things began to look more cheerful. The state of the roads and the weather improved. We were now well clear of Thuringia and once more in Bavaria.

Through the forests, o'er the hills and down the dales the coupé raced along until, on entering Bayreuth, the rain ceased altogether and the sun shone: a great relief.

The Wagnerian Mecca is set amidst fine scenery; but, although it contains a few imposing buildings, it is primarily a busy manufacturing town.

Thence by Kreussen, Sorghof and Hahnbach to Amberg on the Vils; a run of 110 miles over a grand road and through a magnificent piece of country.

From a motorist's point of view this part of northern Bavaria is ideal.

Amberg is the ancient capital of the Upper Palatinate.

Round the walls there is a fine promenade from which delightful glimpses of the towers, gateways and roofs may be obtained.

The rathaus and some of the old streets are reminiscent of the orthodox stage scenery in the "Meistersingers."

There are eleven churches in the place. St. Martin's, a fifteenth century Gothic building, has a graceful spire 300 feet high. The still older Frauenkirche, most venerable without, has been restored in blatant rococo style within: a strange contrast which fills one with dismay.

The hotel was remarkable for the fact that the bedroom furniture did not include a foot-rest for facilitating the lacing of one's shoes; and yet there seemed to be as many fat people in Amberg as elsewhere in Germany. Also it differed from other hotels in the size of its towels. As a rule these are of the same size as table napkins; here they were like small pocket handkerchiefs.

Perhaps the scanty towelling in Germany accounts for Fritz's custom of shaving his head: it is so much easier to dry a bald pate than a crop of hair.

Next morning we drove via Schmidtmühlen to Regensburg on the Danube.

Regensburg has a long history. It was known to the Celts as Radasbona, and to the Romans as Castra Regina. In the early Middle Ages it was an important art centre.

It is a place full of interest and beauty. St. Peter's Cathedral alone is worth a prolonged visit. Both without and within, this splendid Gothic structure charms the eye.

The coupé crawled eastwards along the right bank of the Danube, towards Passau.

What a road!

"Road"? Ye Gods—a nightmare! a pioneers' pathway still in its original condition: a relic of barbarism: and yet, marked on the map as a "Hauptstrasse"!

We banged, bumped, and grunted on at a steady 8 m.p.h., ever hoping for better things, and—wonderful to relate—with springs intact.

To the north, high-placed on a bluff on the left bank of the river, we could see Valhalla—the German Temple of Honour.

This marble building was erected by King Louis I, on the model of the Panthéon.

It houses the bust and effigies, appropriately inscribed, of the Great Ones of the Fatherland.

No one but a Teuton could describe this temple and its contents with the requisite degree of humble reverence and serious enthusiasm.

At the end of twenty-six bone-shattering, nerve-racking miles, we reached Straubing and gave up all idea of ever reaching Passau.

The young fellow who directed us to the nearest passable road smiled on Georgina, and said in English that it was a "beautiful pleasure" to help us.

South Bavaria.—The coupé was headed south once more, and we let her out on a fine road which descended to the Isar Valley.

It was exhilarating to be able to fly along after our wearisome and painful trundle.

Landau is T-shaped. The upright arm of the T lies on a steep slope on the south bank of the river, while the horizontal arm occupies the edge of the ridge above. The road is like the main road through Maldon, Essex, but it is steeper, longer and more winding. We hummed up on second without a check, and pulled up on the crest to admire the view.

The village is a pretty, gay little place. It was bubbling over with good health and spirits and fairly laughed in the sunshine.

A pleasant run through open, rolling country, took us into Eggenfelden: mileage, 112.

We put up at an old-fashioned hostelry in the market-place. The landlord, his wife and daughters, and Sam Weller, each did something for us separately or ensemble, at frequent intervals.

Weller refused to allow Georgina to clean the car. During the washing process he managed to scrape a good deal of the paint off with the nozzle of the hose. When I remonstrated, he was so full of excuses—or guile—that he filled up my boots with water before I was able to capture the hose. No doubt he was an expert farm wagon washer, but . . . .

The hotel was a popular rendezvous. By dinner time the coffee room was filled with a jolly company eating, drinking, and singing to the accompaniment of mandoline and guitar. Everybody was merry and bright and well behaved; good fellowship without a trace of rowdyism.

A huntsman came in clad in Bavarian costume, including a Homburg hat with an immense shaving brush sticking up behind. He handed his birds to Madame, put his gun in the corner, and sat down to a gigantic meal.

More beer, more music and song.

We consulted Madame about the menu. She advised a mysterious dish called "Snitzel Monte Carlo." It contained ten different component parts and weighed about seven pounds. Still, so far as our limited consumption went, it was good.

Sam Weller's voice swelled the chorus. It came from the courtyard, but was quite audible: a high horse-power voice.

A middle-aged woman arrived, expensively dressed, and obviously not a villager. She was accompanied by an old, silver-haired man of venerable aspect. She spoke excellent American and helped us to choose the next item on the menu.

It appeared that Eggenfelden was her native place; but she and her husband had lived in Noo York for many years, and she was now paying her annual visit to her old father. Judging from the amount and size of her pieces of jewellery, she and her husband had succeeded in life.

Her view of the War was entertaining; but instead of swopping trench yarns like Fritz does, she got down to fundamentals. She disapproved of the Hymn of Hate, and said: "I reckon nobody in cold blood wants tew shoot his fellow-man. But yew, an' our boys (i.e., the Americans) an' the German soldiers wur told tew shoot, an' yew all obeyed orders 'cos yew had to. Yep—I guess that's about the size of it; an' all for what? Wa-al nobody knows even now!"

This was getting on to dangerous ground, so Georgina and I retired and, shortly after, the merrymakers dispersed to their homes in a surprisingly quiet manner.

The whole hotel turned out to see us off on the morning of August 10. Sam Weller waved a large bandana which was overdue for the wash.

There followed a most enjoyable drive through beautiful hill and forest scenery. The river Inn was crossed and the coupé climbed the further bank to the picturesque village of Neuötting. Thence along the water-shed between the Inn and the Alz to Altötting.

The latter place was in festival attire and crowded with clerics and devotees. The annual thanksgiving ceremony was in progress at the famous pilgrimage shrine of the Madonna, which stands in the middle of the village green.

It is said that this shrine dates back to A.D. 800. It is certainly very old, and of great interest and repute; but it is not beautiful.

The little circular building is girt by an arcade, on the walls of which are fastened a great number of pictures of every size, age, medium, style, and of varied artistic merit; but each picture deals with the same class of subject.

Every picture tells a story—the same story. The story of the mental and physical afflictions of man and of the miraculous healing powers of our Lady of Altötting.

Nothing is beyond her powers to remedy, and here are pictorial proofs of the healings as they actually occurred from A.D. 800 onwards.

Here is a poor wretch being dragged to the block; here he is minus his head; and here he is with his head stuck on again and as blithe as a lark.

Here is a high-born lady bound to a stake. The flowing tide is just about to enter her mouth and nostrils. Here she is as dead as a kipper: verdict, death by drowning. In the next picture she is breaking out of her coffin, full of good health and spirits; and, in the next, she is rendering thanks to Our Lady.

Some of the pictures are most gruesome and painfully realistic. Art, as the handmaiden of Pathology, can produce horrible effects; and, in this respect, the chapel at Altötting rivals the Weirtz Museum in Brussels.

The bright sunshine, the gaily-decorated streets and the crowds in holiday attire only served to intensify the morbidity of that gruesome arcade.

From Altötting southwards the road is hilly. Great forests stretch away in every direction. Snow water streams tumble down the valleys. The air is fresh and bracing and redolent of pine. The people are a simple, hardy race, and make a brave show in their national costume. Here, at this time of the year, it is good to be alive for the joy of living, laughing, and learning; Kultur and Kur need no artificial aids to success.

(To be continued.)

Current Literature.

MEDICAL RESEARCH COUNCIL. INDUST. FATIGUE RES. BOARD. Report No. 44. **The Physique of Women in Industry. A Contribution towards the Determination of the Optimum Load.** Pp. vi + 140, 38 figs. 1927. London: H.M.S.O. [5s.].

The question of weight-carrying in industry has long been a difficult problem. The present report is a scientific approach to the subject. It follows upon a previous report of the Industrial Fatigue Research Board by E. M. BEDALE into the effects of posture and rest in muscular work. The suggestions then put forward are now reinforced by new records. A question was asked from the Home Office as to what is a reasonable weight for women in industry to be called upon to carry. An answer to this query could only be given after considering the usual physique of women in industry. The subject was therefore approached by examining 4,366 women chosen from various sources; some were university students, but the majority were employed operatives, as well as a small group of unemployed women. Physical data were collected and the strength of each individual was tested by estimating the power of pull, of grip and of crushing between both hands against a calibrated spring. The operatives were employed in various factories, in baking, in tailoring, laundry work, the manufacture of bricks, confectionery and soap. When the data were assembled and carefully treated by statistical method, the facts emerged that the university students were taller, stronger, and more capable of muscular exertion than were the factory operatives; even after allowance had been made for weight, the students were found able to get more out of their muscles. Active minds seem to control active muscles. The unemployed group were found shorter and stouter than the employed group; not only so, but they possessed less efficient muscles. Possibly the reason they were unemployed lay in the make-up of the individuals. Laboratory experiments on the lines of those previously conducted by E. M. BEDALE were carried out to ascertain the physiological cost of porterage by various methods; at the same time the effects upon the pulse

and blood-pressure were noted. It was found that the metabolic cost of the carrying of loads depended largely on the disposition of the load. Any load which brings about any considerable departure from the erect posture, especially if this be associated with induced abnormality of gait, inevitably leads to a high physiological cost. The reaction both of blood-pressure and pulse was found to vary directly with the amount of external work done, but no exact proportional relation was found. On the other hand, a general correspondence between the findings of the metabolic determinations and those of the circulatory reactions was observed. The final conclusions drawn are that the weight of the individual load should not exceed 40 per cent. of the body weight for continuous, and 50 per cent. of the body weight for intermittent or occasional carrying ; these percentages would correspond to 45 and 55 pounds respectively. Observations were also made in a considerable number of industries recognized to be heavy, such as the manufacture of tin-plates, sanitary pipes, aerated waters, paper, cotton, cutlery, woollens, sugar and engineering works. The interesting fact which emerges is that workers in these industries were found to carry just about what had been shown in the laboratory to be the optimum physiological load ; they seem "to be generally self-protective in their choice of the size of load and to know to a nicety their own capacity." In industries where the load to be carried was fixed, it was always found to be well within the capacity of the workers ; only where the choice lay with the workers were heavier weights being carried. Young persons, particularly if males, were inclined to attempt to carry loads which might overstrain them. No adverse effect was found from overstrain due to weight-carrying, and the conclusion is that, under modern conditions, work is not too strenuous for the workers. At the same time the best developed women with the greatest strength were found employed at the heaviest industries; possibly due to occupational selection, possibly also to development brought about by exercise. The less developed appear to filter down to the lighter trades suited to their capacity. The report contains a number of valuable tables and graphs setting out the records made and illustrating how information can be abstracted from such data. [The whole report is one of considerable scientific and social interest, as it establishes now for the first time the physique of women of the present period in Great Britain. The value of the conclusions arrived at for administrative action with regard to weight-lifting is clear.]

E. L. Collis.

Reprinted from "Bulletin of Hygiene," Vol. 3, No. 3.

Collis, E. L. **Industrial Fatigue in Connection with Tuberculosis.** *Tubercle.* 1926, v. 8, 49-58, 5 figs. [4 refs.].

Statistically considered, tuberculosis is a unique disease. Of all the major causes of death it is distinctive, after infant years are passed, in presenting a curve which rises as adult life commences but falls away again before old

age is reached. For each of the other great causes of death, once the curve of mortality has commenced to rise it continues to rise until old age. This rule holds good for the other pulmonary diseases also—pneumonia, bronchitis and pleurisy. The lungs, as measured by their tendency to succumb to these other diseases, are about as resistant at the end of life as at the beginning.

In order to obtain some statistical evidence of the wear and tear factors, the author has made an inquiry into industrial fatigue in connexion with tuberculosis. Fatigue is defined as "the sum of the results of activity which show themselves in a diminished capacity for doing work." Under this heading are included: (1) healthy fatigue or diminished activity which is easily recovered from before the next spell of activity; and (2) over-fatigue which is not so recovered from. The problem for consideration, therefore, is whether healthy fatigue or over-fatigue, either directly or indirectly, influences the incidence of tuberculosis. As far as experimental evidence can be adduced, ordinary fatigue does not appear to lower the resistance to infection. With regard to overstrain the tuberculosis mortality of two of the chief age groups, viz., infancy and early adult life, shows no evidence of an adverse effect. The third age-group, from 40 to 70 years of age, however, shows the influence of pathological conditions resulting from overstrain. The evidence for such influences may be found in three directions: (1) The male phthisis mortality exceeds the female at all ages except 5 to 20, whilst its age of maximum incidence is at about 50, whereas that for females is about 40—in other words, the sex which, on account of its occupational life, is most exposed to strain displays a greater phthisis mortality in the later years. (2) The males, and to a less extent the females, of the urban industrial counties show a greater phthisis mortality than those of the rural counties from the age of 35 onwards. (3) The high phthisis mortality-rate in certain industries; here, however, numerous other factors have to be taken into account. The author concludes that there is need of: (*a*) stimulating anabolism in patients up to 30 years of age; and (*b*) prolonged rest in the case of patients in middle life; that is to say, age may be as important as clinical condition in determining treatment.

S. Roodhouse Gloyne.

Reprinted from "Bulletin of Hygiene," Vol. 3, No. 3.

Mätje. Kohlenoxydvergiftungen in Autogaragen. **[Carbon Monoxide Poisoning in Automobile Garages.]** *Zent. f. Gewerbehyg. u. Unfallverhütung.* 1927, v. 14, 275-7. [2 refs.].

In consequence of several cases of CO poisoning with two deaths in garages in Hanover from the exhaust gases when the engine was allowed to run free, the author undertook analyses of these gases under differing conditions of: (1) motor spirit; (2) load, and (3) the vapour and air entering. The results showed clearly that when the engine ran free CO

was always present in the exhaust gases and, with pure benzene as the motor spirit, reached nearly 10 per cent. The proportions found under unfavourable conditions of running were hardly less than those in ordinary coal gas, but without the empyreumatic substances which call attention to the latter.

The authorities in Hanover now require in every garage metal piping or flexible piping for the purpose of connecting one end of this with the exhaust pipe, the other end being carried to the outer air through a small hole in the wall.

T. M. Legge.

Reprinted from "Bulletin of Hygiene," Vol. 3, No. 3.

Salls, C. M. **Carbon Monoxide Tests in Commercial Garages and Automobile Repair Shops.** *Indust. Hyg. Bull.* New York. 1927, v. 4, 17-20, 2 figs.

The results are reported of tests made of the amount of carbon monoxide present in garages and repair shops. The Sayers-Yant method of estimation was used; this method depends upon the persistence of the red colour of carbon monoxide hæmoglobin in the presence of a bleaching agent that destroys the colour of normal blood. The means used in pursuing this method are described and illustrated. The claim is made that the test is accurate to one part in ten thousand. The results of 121 tests made in 71 work-rooms are given: in twenty-seven more than one part of carbon monoxide per ten thousand was found. This limit is looked upon as excessive. No cases of acute poisoning are known to have occurred, but headaches were frequently reported, ascribed to carbon monoxide emitted with exhaust gases from the cars. Little or no mechanical ventilation was found in use; but a few of the shops were equipped with flexible pipes which were slipped over the end of the exhaust pipes to conduct the noxious gases outside the building.

E. L. Collis.

Reprinted from "Bulletin of Hygiene," Vol. 3, No. 3.

Haldane, J. B. S. **Carbon Monoxide as a Tissue Poison.** *Biochem. J.* 1927, v. 21, 1068-75, 1 fig. [13 refs.] [Biochem. Lab., Cambridge.]

The fact that carbon monoxide is relatively harmless to invertebrates, micro-organisms and plants, which do not depend upon hæmoglobin to supply their tissues with oxygen, is held to prove that carbon monoxide is not in itself poisonous. The present paper reports experiments made by exposing seeds, moths and rats to atmospheres containing varying amounts of oxygen and carbon monoxide. The result is to show that a greater amount of oxygen must be present, if carbon monoxide is

also present, to maintain normal reactions than if no carbon monoxide is present. The movements of moths and germination of cress seeds were inhibited by CO; and the greater the partial pressure of oxygen, the more CO was required. Rats were kept alive in an atmosphere containing sufficient CO to combine with all the hæmoglobin of their blood, by submitting them to oxygen at several atmospheres' pressure so that sufficient oxygen was dissolved in their blood-serum. If, then, more CO was added, death resulted. The conclusion is drawn that living tissues contain a catalyst of oxidation which is poisoned by CO, in addition to the action, in the case of vertebrates, of CO upon hæmoglobin. The nature of the catalyst is uncertain; it may be an iron-porphyrin derivative, a component of the polyphenol oxidase system. Such catalysts may be required for the oxidation of a variety of substances; they are present in bacteria, yeasts, higher plants, insects and mammals.

E. L. Collis.

Reprinted from "Bulletin of Hygiene," Vol. 3, No. 3.

Cramer, L. G. F. **Some Notes on the Deratization of Ships.** *Meded. Dienst. d. Volksgezondhied in Nederl.-Indië.* 1927. Pt. 3, 650-79, 4 figs. & 12 photos.

This article gives a fairly comprehensive account of the practice and experience of claytonizing in the Dutch Indies. Risk of transmitting plague through cargo is chiefly through that which affords nesting place for the rats, or "rat attracting" cargo (rice, flour, salted fish, copra, maize, etc). The Dutch Indies have to import much of their food (8-12 per cent of the rice consumed is imported) and of "rat attracting" cargo about 600,000 tons annually.

Three-monthly deratization is demanded of ships in the oriental trade; other measures of plague prevention are rat shields on moorings, booming-off (two metres), hoisting of gangways above barge decks (one metre), deratization of barges, rat-free go-downs.

SO_2 is usual for disinfecting. The port of Tandjong Priok has a Halley apparatus; all other ports use the Clayton and sulphur pots. A 2-per-cent. atmosphere as measured at the outlet of the machine for empty holds and 4 per cent. for full holds is demanded, and the pumping operation must be continued one hour after this has been obtained.

8,678 vessels (not including lighters) were fumigated in 1925 in the Dutch Indies.

The author does not "underwrite" the unfavourable opinion of the SO_2 methods freely expressed. After describing the Clayton and Halley apparatus, he shows the importance of measuring the percentage of SO_2 in the gas delivered from the Clayton apparatus and that the handling of the machine is a skilled job. [The machine selected should be capable of

throwing a high percentage and large volume without being taxed to its full capacity.]

Sampling of gas in the holds was done by means of long glass tubes into which the atmosphere was drawn by running off water from a vessel connected with the tubes at deck level. The analysis is made by dripping in Lugol solution until no further change in colour is found and reading off the percentage volume of water admitted in graduations on the tube. A 5-per-cent. atmosphere only may be obtained in an empty hold one hour after 10 per cent. has been ascertained. Water (condensation or bilge) accounts for the great absorption.

It is not advisable to fumigate holds full of cargo, because of damage and of inefficiency due to condensation and absorption in the cargo.

The sulphur-pot method yielded hold atmospheres of 1-1·5 per cent. (temperature 38° C. 56-100 grm. S burned per cubic metre). At Sourabaya, the rat population, in lighters disinfested by the pot method, decreased from 10 to 0·1 per lighter in 1913. Objections to SO_2 fumigation are its applicability to empty holds only, and its damage to paint and metals. The author thinks the omission of the engine room in fumigation of no great importance, while finished metals in cargo are generally painted or greased and so preserved. But other methods deserve recommendation because of the objection to SO_2. CO kills rats, but not fleas, and is dangerous to human life, as is HCN. It is in use in Japan and Shanghai. Of HCN methods the author prefers Cyclon, but the ship needs to be abandoned to the fumigators for twenty-four hours and the material for fumigation must be ordered from abroad. Despite drawbacks, the Clayton method is that by which shipping is least hampered in Dutch East Indian waters.

The appendices to the article detail some typical fumigations in which experiments were made, the methods of experimenting, a list of decreed "rat attracting" cargoes and the reports of a "Claytonnage Committee." A bag of wet rice, claytonized and stored, lost the smell in three days and was declared improved in quality by bleaching, and on further test "not reduced in commercial value." Souring of boiled claytonized rice is delayed. Commercial value was found reduced in claytonized imitation gold paper, cotton carpets, half silk embroidery, brass curtain hooks, nickel-handled umbrellas, imitation gold and silver glass beads, brass tape, silver watch chains, tobacco.

W. M. Willoughby.

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Reviews.

MODERN METHODS IN THE DIAGNOSIS AND TREATMENT OF GLYCOSURIA AND DIABETES. By Hugh Maclean, M.D., D.Sc., F.R.C.P. Modern Medical Monographs. London: Constable and Co., Ltd. Fourth Edition. 1927. Pp. x + 212. Price 12s.

In the fourth edition of this popular monograph the main text remains unaltered, but several minor additions have been made in order to bring it into line with the rapidly increasing knowledge on the subject.

As might be expected most of the additions deal with the use of insulin, concerning which it is considered that the experience accumulated during the last few years is now sufficient to permit a more or less definite pronouncement as to its true position in diabetic therapy.

No changes have been made in the various biochemical tests which have proved so useful and reliable in the past, nor in the detailed description of the dietetic methods of treatment.

The question of the type of case for which insulin may be indicated is carefully considered, and the author recommends that it should be given at once to all severe cases, and also to all other cases which cannot be readily controlled by dietetic means. In some mild cases diet alone may control the condition, at least for a time, and insulin may not be necessary. Particular care should, however, be taken to guard against the onset of eye symptoms in elderly patients with chronic diabetes, as complete and permanent blindness is very liable to supervene unless insulin be promptly administered.

Severe attacks of hypoglycæmia should not now occur, but the prevention and treatment of this dangerous complication is fully described. A word of warning is given as to the effect of insulin on patients suffering from angina pectoris or marked cardiac degeneration. Even a mild degree of hypoglycæmia may start an attack of angina, which in this condition is likely to be very severe and often proves fatal.

Clear and detailed instructions are given for treatment with insulin, and a method is described by which insulin in graduated doses may safely be injected without any blood-sugar estimations to control its effect.

During treatment with insulin the author recommends that the patient should be placed on a fixed diet containing sufficient calories to maintain nutrition, and that then the dose of insulin be very gradually increased until the blood-sugar is within normal limits.

Very useful and practical rules are given for the treatment of diabetic coma. It is not considered necessary in this condition to give sugar with the insulin when the necessary facilities for carrying our blood-sugar estimations are at hand, but otherwise it is best to give sugar by the mouth as soon as definite signs of improvement appear.

The monograph is thoroughly up to date and well maintains its position as the most popular and practical standard work on the subject. It should, undoubtedly, be in the hands of all clinical and laboratory workers likely to have to deal with cases of diabetes.

A Textbook of Infectious Diseases. By E. W. Goodall, O.B.E., M.D., B.S.Lond. With 26 plates (including six coloured) and other illustrations, 15 diagrams and 34 charts. London: H. K. Lewis and Co., Ltd. 1928. Price 30s. net.

This, the third edition of the well known "Manual of Infectious Diseases" by Goodall and Washbourn, has been largely re-written. Two new chapters on "Encephalitis" and "Epidemic Poliomyelitis" have been added, and the text generally contains much new matter. On the other hand the chapter on plague has been omitted.

The book consists of six introductory chapters and nineteen others dealing with specific diseases. It is possible that the introductory part could with advantage have been shortened. Many of the definitions are so elementary that it is doubtful whether their inclusion was necessary. The chapter on "Contagion and Infection" contains matter which is to be found in every textbook on bacteriology. While admitting the desirability of its inclusion for the sake of completeness, it is questionable whether such fullness of detail and repetition of what has already been learnt elsewhere, were really necessary. Lastly, it might have been preferable to relegate the section on epidemiology to an appendix.

Of the main part of the book nothing can be said but praise. It is not only thoroughly up to date, but eminently readable, a qualification which is by no means possessed by all scientific books. Especially good are the sections on differential diagnosis and treatment. As regards the latter, the author gives details which are frequently lacking in medical textbooks and have to be painfully acquired in practice.

I have no hesitation in thoroughly recommending the book, both to senior students and practitioners, as a most valuable aid to the thorough knowledge of the diagnosis and treatment of infectious diseases.

Standard Catalogue of Scientific Apparatus, 1928, Vol. I: Chemistry. Published by Baird and Tatlock (London), Ltd., London, England.

This catalogue, most attractively and well bound in blue, is a most expensive book to read, as the articles in it are so tastefully portrayed, and the descriptions of the various pieces of apparatus so interesting that the reader feels he must proceed to the premises of the firm and spend more than he can really afford in making his laboratory modern. Most probably that is one of the underlying principles in every catalogue, but this one is a most useful book of reference.

It is firstly a book of reference to the busy scientist who wishes to keep in touch with latest developments but cannot spare the necessary time for reading through the long records of research published on the various

journals. For example, the articles on the polarimeter and on hydrogen-ion concentration are so lucid that many writers of textbooks would do well to bear them in mind when preparing new editions of their books. Secondly, to the man specializing in medical chemistry this volume may not be quite so interesting as other volumes in the series; but, nevertheless, it will prove useful on the shelves of his library.

And thirdly, people who have the care of stock lists in large institutions will find reference to it most useful for purposes of identification of the rarer pieces of apparatus, as the catalogue is very comprehensive and full of illustrations.

Lastly, and by no means least, the buyer of apparatus away in the outposts of the Empire can with its aid see exactly the type of material he is ordering.

In addition to the list of apparatus and prices, there is a section devoted to books of a scientific nature pertaining to the material in the catalogue. There is also a price list of chemicals, dyes, stains and indicators including those very useful A.R. reagents which must comply with stringent specifications for purity. The index is admirably arranged.

Of course in a work of this nature, foreign made articles are necessarily included, but it is interesting to note that each one appears to have a British-made counterpart, and the price of the latter in practically every case compares favourably with the foreign article.

The book is enormous, it has nearly twelve hundred pages of good quality paper, printed very clearly, it weighs over six and three quarter pounds and must have entailed a very large amount of skill and patience in its compilation, and the firm is to be congratulated on its production.

S. E.

ARBEITEN UBER TROPENKRANKHEITEN UND DEREN GRENZGEBIETE. Bernhard Nocht zu seinem, 70. Geburtstag gewidmet von Freunden und Schulern. Kommissionsverlag L. Friederichsen & Co., Hamburg, 1927. Pp. 643.

This work has been conceived as a memorial of their appreciation and gratitude to Professor Bernard Nocht, founder and director of the Hamburg Institute of Tropical Medicine, by his pupils and staff, past and present. The volume contains eighty-nine articles on different branches of tropical medicine by men of all nationalities. As is to be expected the value and interest of the papers vary considerably. It is impossible in the space available to attempt a summary of the contents, only the more important ones can be mentioned. Of these I consider the most valuable to be :—

An article by Plehn (p. 409) on the "Possibilities for Malarial Research under the Modern Therapy of late Syphilitic Manifestations." Malarial attacks which have been artificially produced and are kept under control from the start, give unrivalled advantages for the investigation of such problems as incubation periods, varying activity to different malarial strains,

re-infection, multiple infection, etc. The author points out that in these late syphilitic cases we have clinical material in which such artificial production of the disease is legitimate as a means of cure. The unique opportunity calls for close co-operation of bacteriologists and alienists. The author gives most interesting results of personal investigations.

A paper by Celli (p. 49) on the "Importance of Malaria for the History of Rome in Antiquity and in the Middle Ages," calls attention to the cyclical prevalence of the disease, cycles not to be measured in months or years but in centuries. Four times in the last 2,000 years has malaria reached its acme in the Campagna, only to die down again in intervals, when the deserted land became once more the site of populous cities. The theory is supported by historical data.

An interesting case of treatment of sleeping sickness by germanin followed by antimony is given by Fischer (p. 99). The patient recovered.

Other papers of special interest are:—

Moldovan: "Seat of the Anaphylactic Reaction" (p. 345).

Paschen: "The Use of Dried Vaccine Lymph as a Control of the Virulence of Vaccine" (p. 397).

Seyfarth: "Cases of Hodgkin's Disease with Periodic Temperatures" (p. 517).

Notice.

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Royal Army Medical Corps.

Original Communications.

THE PATHOLOGY AND TREATMENT OF TRAUMATIC (WOUND) SHOCK.[1]

BY LIEUTENANT-COLONEL ERNEST COWELL, D.S.O., M.D., F.R.C.S.

Royal Army Medical Corps (T.A.).

Contents.—I, Introduction; II, Conception of Shock before 1917; III, Work of Shock Committee (Medical Research Committee); IV, Front Line Observations; V, Pathology of Circulation in Shock; VI, Toxæmic factor in Shock; VII, The Central Nervous System; VIII, Metabolism in Shock; IX, Present Conception of the Pathology of Shock; X, Treatment; XI, Summary; XII, Bibliography.

I.—INTRODUCTION.

INTEREST in the subject of traumatic shock has recently revived. At a meeting of the Surgical Section of the Royal Society of Medicine, held early in this year, a criticism of current views was made by Mr. Zackary Cope and discussed by several surgeons.

It was agreed that although our knowledge of the subject is now reasonably complete, the general acceptance of such views is still far from being universal, and the teaching expressed in the current textbooks is confusing and even misleading. Authorities have not agreed on a precise definition of "shock," and find difficulty in clearly differentiating between "shock" and "collapse." At the Sixth Meeting of the International Society of

[1] A paper read at the meeting of the War Section of the Royal Society of Medicine, held on March 12, 1928. Published by kind permission of the Society.

Surgery, held in London in 1923, Professor John Fraser, of Edinburgh, read a valuable paper on "Operation Shock" [1].

Fraser's definition is not quite comprehensive, but is one of the best hitherto put forward: "Shock may be defined as a state of depression of all the vital functions of the body, the state being primarily induced by the infliction of injury on the body tissues, and being characterized by a progressive fall of the blood-pressure."

Cope's definition is a little fuller, but omits to mention the blood-pressure: "The term 'shock' signifies a condition following the application of harmful stimuli, or the depletion of the body fluids, in which there is a serious and clinically demonstrable depression of the vital processes of the body, particularly the circulation and metabolism."

It is difficult in a short polished phrase to give a complete verbal description of what is meant by shock.

Cannon says [2]: "It seems to me that, in such a complex as shock, definition is not a prime requisite. The important matter is to obtain a careful description of the observed facts." For practical purposes I think, however, it is useful to endeavour to describe the pathology of the condition in a few words. In order to give a clear conception of "shock," I would suggest the following:—

"By 'shock' is meant that clinical condition produced by an injury which induces depressed vitality associated with lowered blood-pressure, deficient circulating fluid, diminished intracellular oxygenation and reduced body temperature. Such a condition results from the presence of one or more of the following four factors, acting either singly on in combination: (1) Pain, (2) hæmorrhage, (3) cold, (4) toxæmia either of bacterial, tissue (protein) or other origin."

II.—Conception of Shock before 1917.

The early view of the pathology of shock was, as in the case of so many other conditions now better understood, that it was of nervous origin.

Malcolm, Lockhart-Mummery, Crile and others believed that shock was a nervous phenomenon associated with peripheral vaso-constriction, splanchnic dilatation or exhaustion of the cerebral cells. A deficiency of circulatory fluid was recognized, but further details were not known. A large number of theories existed, but actual observed clinical facts were few and definite pathological details almost unknown.

III.—The Shock Committee.

An immense stimulus to those interested in "shock" was provided by the publication of the Medical Research Committee's "Memorandum upon Surgical Shock and some Allied Conditions," in February, 1917. The work of Dale and Laidlaw on histamine shock and to a lesser extent, perhaps, that

of Bainbridge and Trevan on adrenalin injections, opened up a fresh field of thought. The Shock Committee co-ordinated research, infused fresh enthusiasm in the minds of the workers concerned, and at the end of the year (1917) published many valuable original observations on the condition.

In France a group-research was organized in the First Army area. Professor Cannon and John Fraser worked in the laboratory and surgical wards of a casualty clearing station in Bethune. My part of the work in the front line and forward areas was to make observations on the early condition of casualties which were subsequently evacuated to this casualty clearing station. In this way the complete histories of many cases of shock were obtained, observations being made before wounding, at the time of wounding, and at periodical intervals during the stage of evacuation.

IV.—Front Line Observations.

I must apologise for repeating here observations which have been, for the most part, already published in the Medical History of the War [3] or in my Arris and Gale Lecture of 1919 [4]. It will be possible, however, to enter into fuller details in this present paper, where my audience will be familiar with the front line conditions referred to.

Early in February, 1917, I spent a short time at "Lone Farm" advanced dressing station, which was about one thousand yards behind the front line trenches in the Givenchy-Festubert sector. Notes of several cases were made and a report was submitted to the Consulting Surgeon of the First Army, Sir Cuthbert Wallace. These notes have not hitherto been published.

The weather conditions were favourable for the development of shock. There was a hard frost and often a keen wind blowing. The troops holding the line were Fifth Division men of exceptionally good physique. There was no very active fighting at the time, and the casualties that came under observation were generally men hit at night on working parties or carrying up rations, &c. The wounds observed were caused by machine-gun fire or "whiz-bangs."

My observations were made in the A.D.S. at varying times after the receipt of the injury. Some of the casualties had lain out several hours in the darkness before they could be got down. The following are extracts from notes written at this time:—

"Observations made in the line on a series of recently wounded show that the maximum systolic blood-pressure seldom remains between the normal limits, but rises or falls 20/30 millimetres of mercury.

"The first class, i.e., raised pressures, may be subdivided into four groups:—

(1) Cases of slight and moderately severe superficial wounds.
(2) Head wounds at certain stages.

(3) Certain cases of wounds of the liver.
(4) Certain cases of wounds of the chest.

"In the first group readings of 140/160 millimetres are the rule and appear to be due chiefly to excitement. The pressure drops usually in a few hours to 115/120 millimetres.

"In the second group a high-pressure is maintained in cases of cerebral compression, as long as the medullary vasomotor mechanism is intact. The pressure does not drop until the patient is actually dying.

"In the third group some wounds of the liver have been found to maintain a pressure of 130/140 millimetres for twelve to twenty-four hours, possibly as a result of absorption of pressor substances from pulped liver tissue. A penetrating wound of the abdomen with injury to one or two coils of intestine will show a pressure of 115/120 millimetres for the first two or three hours.

"In the fourth group, where there is a small wound causing a pneumothorax with dyspnœa, a pressure as high as 170 millimetres was observed, maintained for many hours.

"In the second class, i.e., lowered pressures, the pulse becomes imperceptible to the finger when the pressure falls below 90 millimetres. With a delicate spring manometer (Tycos), and employing the auscultatory method, a pressure as low as 40 millimetres can be readily observed.

"Four groups may be recognized :—

(1) Cases of severe hæmorrhage.
(2) Cases of gross injury.
(3) Cases of multiple shell wounds.
(4) Certain cases of flesh wounds of thigh and buttock.

"In the first group the pressure falls rapidly, and may reach 50 to 60 millimetres by the time the bleeding is checked. The pressure remains low, 90, 100 or 115 millimetres, for some weeks, long after the initial shock has passed off, even when sepsis does not supervene.

"The second group includes all the more severe cases, and the massive wounds which must necessarily prove mortal. Many patients with uncomplicated compound fractures of the femur or even humerus, suffer severe shock which may be fatal a few hours later. In the cases which survive, the relation between low pressure and gas gangrene has not yet been fully worked out. It seems probable that the condition predisposes to the onset of gangrene by diminishing the local as well as the general resistance and so allowing the organisms to gain an entry.

"In the third group, multiple shell wounds produce severe shock just as extensive burns do. One typical case occurred when it was possible to count 152 separate small wounds. The patient remained pulseless for thirty-six hours, and then responded to warmth and saline injections.

"In the fourth group are those cases well known, especially to regimental medical officers, of clean perforating single bullet wounds of the fleshy part of the buttock or thigh, without injury to the pelvis, great vessels, nerves or bone, that are liable to cause death from shock in a few hours. Two

cases of perforating bullet wounds of the buttock gave pressures of 50 and 45 millimetres respectively, three hours after being hit. (The importance of the cold factor was not appreciated at this time.)

"As regards treatment, beyond first aid, small doses of morphia, and accelerating evacuation, but little can be done until the patient reaches the advanced dressing station. Here hot drinks or saline injections may be given. In one or two cases nerve blocking with one per cent novocain was tried. It was only possible to do this, however, at a stage when shock was established and the object of the injection therefore defeated."

Looking back on these notes in the light of subsequent observations, several points stand out: (1) The cold factor was not appreciated at first; (2) the relation between the amount of shock and muscle injury was noted; (3) the fact that shock was often slow in its onset was observed.

In the summer of 1917, I was engaged in observations on shock cases in No. 23 casualty clearing station at Lozinghem. Cases were received here chiefly from the Loos Sector, where rapid evacuation was often difficult.

Professor Cannon spent several weeks making observations here, and the effects of various hypertonic solutions, including gum, were tried at the suggestion of Professor Bayliss. In September, 1917, I was fortunate in obtaining permission from the D.M.S. First Army, the late Major-General Sir H. N. Thompson, K.C.M.G., C.B., D.S.O., to proceed to the Loos Sector and to attach myself to whatever unit gave the greatest opportunity for making the observations I was seeking.

I spent varying periods at the dressing station at Philosophe, the advanced dressing station at Fort Glatz, in Loos, and at a regimental aid post on Hill 70. Making the last-mentioned my headquarters, I was able to spend many nights in the trenches in such places as the "Quarries," on the other side of Hill 70, or to move to other battalion areas in the neighbourhood when a raid was planned. Studies were made of the physiology of the fighting soldier at these various points, under "quiet" conditions and during fighting.

Physiology of the Fighting Soldier.

A number of blood-pressure observations were made of men of varying ages in the quiet areas. The maximum systolic pressure was found to vary between 110 to 125 millimetres of mercury, and the diastolic between 75 and 80 millimetres. Under excitement the pressures were often found to be raised in unwounded men. The following paragraphs are quoted from my Arris and Gale lecture [4]:—

"Perhaps one of the most fascinating subjects in physiology is the study of the reaction of the body to excitement. Of the psychical stimuli which result in extensive physiological processes, that of the excitement of battle probably comes first, converting the normal human machine into a fighting mechanism. Cannon and also Elliott found that, as the result of excitement

in cats, sympathetic stimulation set free adrenalin, which could be detected in the circulation soon after the initial stimulus was applied. The main effects of this circulating adrenalin are to increase the heart-rate, raise the blood-pressure, set free glucose from the liver in response to the demand of the muscles for more foodstuff, inhibit the movements of the alimentary canal, and diminish the coagulation time of the blood.

The utility of these bodily changes is obvious, enabling the man to do more muscular work, withstand fatigue longer, and, in the event of his being wounded, hastening hæmostasis. As will be shown later, it is possible, however, that the secretion of adrenalin over a prolonged period may be harmful, and that prolonged excitement may prove to be one of the factors in the initiation of wound shock. The observations I have been able to make on the effects of excitement on soldiers show that a stimulus such as exposure to the danger of enemy fire produces a reaction which, as might be expected, varies greatly according to the individual. Intellectual development, temperament, habitual exposure to danger in war or civilian occupation, and fatigue, all have a bearing on the physiological reaction, as estimated by the sphygmomanometer. The effect of temperament is shown in the following cases :—

At 2 a.m. on a dark night in the autumn, I was able to collect records from six men in a battle-aid-post situated in the Hulloch sector of the line. The men under observation were all slightly wounded, and had just dropped back into the trench after having "gone over the top" on a raid. The artillery and machine gun-fire to which they had been exposed was severe. The men belonged to one of the battalions of the Lincolnshire Regiment, and were in civil life farm labourers of particularly phlegmatic temperament.

No. 1.—A slight wound on the face. The man took everything as a matter of course, and sat quiet without speaking. Pulse, 76; blood-pressure, 115 millimetres.

No. 2.—Bullet wound of the hand; some pain. This man was talkative; later sang and showed signs of mild excitement. Pulse, 126; blood-pressure, 130 millimetres.

The other four men had all come in at the double and were panting when first seen. Pulses and respirations slowed quickly on resting.

No. 3.—Slight wound of chin. Respiration, 36; pulse, 144; blood-pressure, 115 millimetres.

No. 4.—Perforating bullet wound of arm. This man was rather pale, but was quite cheerful, and had not lost blood. Pulse, 120; blood-pressure, 120 millimetres.

No. 5.—Slight bomb wound of the buttock. Pulse, 124; blood-pressure 115 millimetres.

No. 6—Slight wound of the face. This man was of less robust physique than the others and looked in a bad way, with a pale face and weak voice. He wanted to lie down, having given in completely. There

was no serious wound to account for this. Pulse, 112; blood-pressure, 120 millimetres.

Observations on Garrisons of a Detached Outpost.

A few weeks later I was able to take advantage of the full moon to collect blood-pressure records of a garrison of a detached outpost, known as "the Quarries," on Hill 70, situated in a new part of the line that was somewhat exposed. The men were organized into a series of posts, where they had been on duty for four nights and four days, with only brief snatches of sleep in the daytime. The nights were cold, and, although the men were well fed, the water ration was only ten to fifteen ounces per man per diem. The following figures were written down in the order in which the readings were made. When the enemy fire came within a few yards, a note was made as shown on the chart.

Post	B.P.	Remarks
1	118-80 126-90 116-80	Quiet
2	120-80 116-75 140-80	Fairly quiet
3	150-90 150-90 150-80 140-70 140-70 160-90 (*a*) 140-90 (*a*)	In sap leading to enemy's lines. (*a*) Two last men just knocked down.
4	118-70 140-90 140-80 150-90 (*b*) 130-90 130-90 140-90 120-90 (*c*)	Quiet, but not very far away from 3. (*b*) N.C.O. in charge; (*c*) O.C. on his round
5	120-80 120-80 120-90 126-76 128-75 130-90 (*d*)	Quiet. (*d*) Serjeant
6	136-85 120-80 120-80 140-80 120-75 130-80 110-60 120-65	Quiet. Several Véry lights
7	110-80 (*e*) 120-60	(*e*) Two years in the line
8	138-80 130-75 120-85 130-90 130-80 124-70 (*f*) 136-70	Important M.G. position. (*f*) Very cold
9	140-90 130-80 110-60 120-90	Slightly active
10	160-90 150-90 120-70 104-70 (*g*)	Sentries at Coy. Headquarters. (*g*) Two years in the line
11	118-80 130-90 116-60	Stretcher bearers and guide
12	130-90 140-90 118-80 140-90	Patrol party after $1\frac{1}{2}$ hours' march in the trenches

This evidence of raised pressure and the possibility of its having been associated with excess of circulating adrenalin is interesting in view of the observations of Bainbridge and Trevan on the effects of "a long-continued or slow infusion" of this substance.

In anæsthetized dogs thus infused intravenously, so that the arterial pressure was kept at a supra-normal level, a steady decrease in the volume of blood-plasma occurred with a corresponding increase in the viscosity of the whole blood. After the injection was stopped the pressure rapidly fell to a low level, and the animal passed into a condition of shock. I do not claim this increased adrenalin content of the blood is the sole factor, but think it may be indeed one of the many contributing factors and one of practical importance.

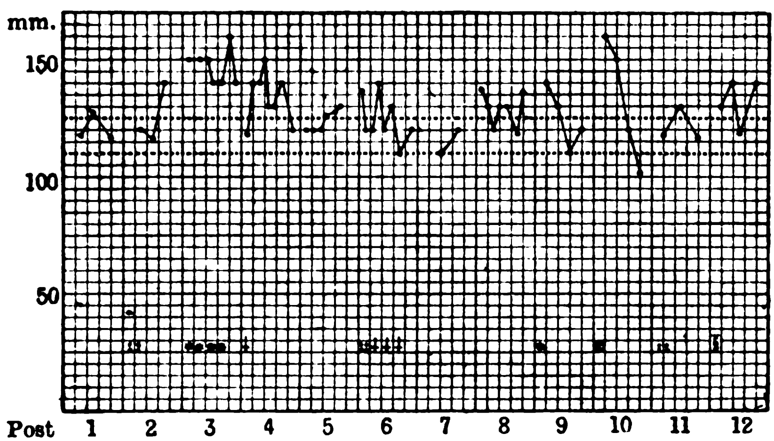

FIG. I.—Chart showing blood-pressure records under stress. ‡ Machine gun bullets. * Rifle grenades. † Véry lights. § Shell.

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Blood-pressure in the Wounded.

These observations were made immediately, or within a short time after, the man was hit.

In the trivial wounds, while transient psychical disturbances sometimes result, and the man becomes momentarily faint, the hypotension does not exist long enough to be measured. On the other hand, in slight wounds, the pressure is more often raised. For example, a strong healthy young gunner was slightly wounded with a few shell splinters. He walked to the dressing-station, and was seen half an hour later. His face was flushed and his pressure was 180-100. His colour was now normal and he was sleepy. Examination of large numbers of wounded make it possible to divide wound shock into primary and secondary varieties.

Primary Wound Shock.

Serious wounds do not always produce shock. Where, however, the damage sustained by the body is such that death must supervene unless immediate surgical intervention is possible or available, the pressure falls with great rapidity and the symptoms of wound shock are found to have become established as soon as the patient is seen. To this class of case I have given the name "primary wound shock." It is an unavoidable condition, but one which in favourable cases may be kept from progressing, and later terminate in recovery.

The following illustrative cases of primary wound shock may be quoted :—

(1) An ambulance driver, as he stepped off his car on arrival at the dressing station (Fort Glatz) one bright sunny morning, was hit in the abdomen by a shell fragment. He fell down, was carried in, and put on the dressing-table at once. As he was being attended to he drew the attention of the medical officer to his profuse sweating. I saw him thirty minutes later as he passed the next relay post on his way to the operating centre. He then complained of severe pain, looked pale, and was still sweating profusely. His hands were cold and clammy, pulse 96, pressure 100-70. On arrival at the clearing station an hour later his pulse was only 100, but the pressure had further dropped to 82-70. Operation was immediately performed, hæmorrhage stopped, and ten rents in the bowel repaired. The man's condition was serious for some hours, but he responded to treatment and eventually recovered.

(2) On a cold, wet, muddy night a man was seriously wounded by a shell while digging a new trench. He was brought to the advanced dressing-station fifty minutes later and found to have sustained severe multiple wounds, including compound fractures of femur and humerus. The exposed lacerated muscle looked like dead tissue, there were no vessels of any size bleeding, and hardly any capillary oozing. The blood pressure was 40. Mentally the patient was quite bright and responsive, so that the medical officer-in-charge of the case remarked how wonderfully fit he was. The man was dead, however, within the hour.

Secondary Wound Shock.

The conception of secondary wound shock brought new hope to those concerned in the treatment of the wounded soldier. From a study of the following cases, various factors were recognized in the onset of shock. Control of these factors by simple means of treatment was established with magnificent results.

In a large proportion of the serious wounds symptoms of shock supervene after the lapse of some hours. Early observations showed no alteration in pulse-rate or blood-pressure level. During the next few hours,

however, in the presence of certain factors, the pressure was found to fall, the pulse-rate to rise, and the state of shock to become established. To these cases I have given the name "secondary wound shock." I will first describe two cases where wound shock did not develop, although its onset might have been expected.

(1) One dark night the driver of a gun team was hit in the abdomen by a small shell fragment. He got off his horse to make inquiries for the dressing station, and then rode nearly a mile before being seen by the medical officer. He was then quite fit, with a blood-pressure of 120, which did not drop either before or after admission to hospital. At the operation two small rents in the bowel were found and sewn up.

(2) One evening a man on a ration party was hit in the thigh by a shell fragment at the moment he was passing the entrance of the aid-post. He was carried down a few seconds later and found to have sustained a compound fracture of the femur. I found his pressure 120-80, and pulse-rate 72. He was immediately splinted and sent on to the dressing station, where he remained under observation for six hours, and finally reached the casualty clearing station without at any time showing hypotension. The front line application of the Thomas's splint was employed, and there was a sufficiency of blankets.

In the next two cases the wounds were by no means serious in themselves, but secondary wound shock developed.

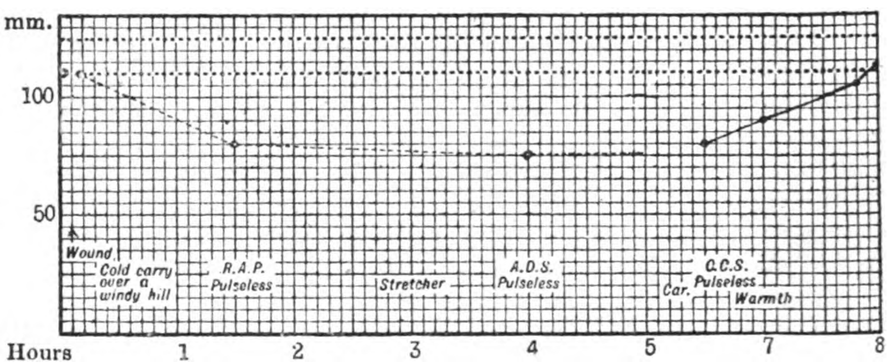

FIG. 2.—Secondary wound shock. Case 3, bomb wound of neck and foot, not severe. (Reproduced by permission of the *Lancet*.)

(3) A man belonging to the garrison of the Quarries was wounded by a bomb which partly shattered the forepart of his foot and sprinkled his neck and shoulder with tiny fragments. His chum, standing by his side, was killed. The blood-pressure, which I had found was 110-70 a short while previously, was still the same immediately after he was wounded.

It was a cold night, with a chilly wind, and as the man was carried shoulder-high along shallow trenches winding over Hill 70 he became colder

and colder. At this time, too, there was occasional enemy activity. By the time he reached the aid-post, an hour and a half later, he was pulseless, and a serious view was taken of his condition. He was hurried on to the casualty clearing station, where he arrived with a pressure of 80-65 and no palpable pulse. After being warmed up in bed the pulse soon returned, and the shock passed off in the absence of any heroic measures of treatment.

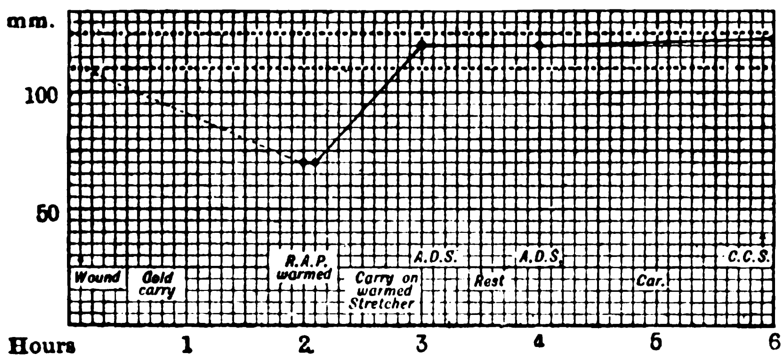

FIG. 3.—Secondary wound shock, rapid recovery. Case 4.

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(4) Early one night in October a young soldier on a wiring party sustained two simple perforating machine-gun bullet wounds through the fleshy part of the thigh. There was no extensive laceration of the muscles and no hæmorrhage. After two hours carry in the cold I saw him at the aid-post. His condition appeared grave, his face was pale and cold, with blue lips and anxious expression. He complained greatly of thirst, presented a small, thready pulse and a blood-pressure of 70-50. He was given a hot drink, well wrapped up, and sent on. In the next hour, while continuing his journey under these conditions, he recovered so well that the medical officer who made the next observations could not understand why I had been so anxious about the patient. By this time the pressure had risen to 120-80, and did not fall again.

The following cases deal with amputation of limbs by gunshot wounds and the question of toxæmia playing a part in the onset of shock.

(5) When going down a communication trench about 2 o'clock one mild morning, early in September, 1917, I met a stretcher party carrying a man with his leg blown off. At the aid-post the patient was found to be a strong burly lance-corporal with some reputation in the battalion as a boxer. He had been wounded about an hour before by a trench mortar, which had carried away his left leg a hand's breadth below the knee, and at the same time severely iujured the right tarsus. He lay quite calmly

on his stretcher, and answered questions readily. The pulse was 96, and the systolic pressure 115. None of the symptoms or signs of shock were present; what little hæmorrhage there had been had stopped. The man was warmed, given as much cold water as he wanted, had his wounds dressed, was well wrapped up, and then sent on his journey. I followed him for the next three hours as he was carried over the open to Fort Glatz, taking frequent pressure readings. When I left him his face had become flushed and the pulse-rate had crept up to 120, but the pressure remained level at 114-70. On arrival at the casualty clearing station an hour later his pressure had fallen to 88-62 and the pulse-rate risen to 144. The muscles of the stump were found to show signs of gas gangrene. After re-amputation his condition improved, and he soon recovered.

This case I regarded at the time as an example of bacterial toxæmia. McNee and others have drawn attention to the speed at which anaerobic infections may become established and produce their potent effects. The work of Bayliss and Cannon [5], which will be discussed in detail later, introduces the possibility of a new factor, that of absorption of the toxic products resulting from disintegration of muscle tissue apart from infection. In this case, if immediate re-amputation had been performed, or at any rate a ligature tied round the stump to prevent absorption, the secondary wound shock would in all probability have been averted. In the next case this principle of treatment was adopted with success.

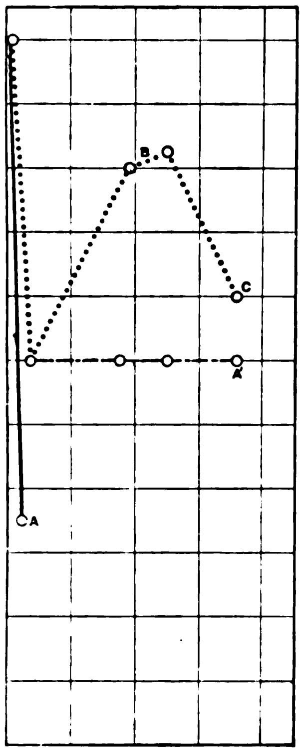
(6) A strong muscular soldier received a severe shell wound of the left arm, shattering the humerus. Within a short time a Canadian regimental medical officer, who was familiar with the view expressed in the preceding paragraph, saw the man and performed immediate amputation under an anæsthetic, thereby removing all the traumatized tissue. Four hours later I saw the patient at the next relay post. He was pale but quite fit, with a maximum blood-pressure of 140 and a pulse-rate of 90.

It has been frequently noted clinically that a patient under operation for removal of a shattered limb will show an increase in pulse-rate and respiration with lowering of the blood-pressure a few minutes after the tourniquet has been relaxed. Latterly it was taught that in cases where the application of a tourniquet was necessary, the medical officer should apply it as near to the damaged tissue as possible so as to allow of amputation with the original tourniquet *in situ.*

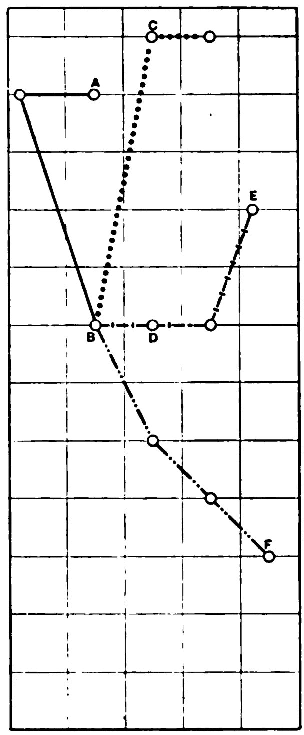
Relation of Primary to Secondary Shock.

Fig. 4 shows diagrammatically the possibilities in a case of primary wound shock. From a practical point of view the importance of closely watching the patient during the period immediately subsequent to the onset of shock cannot be too urgently insisted on. Otherwise the favourable moment (B), will be missed, and the primary merge into secondary shock without the patient being given the benefit or opportunity of surgical

intervention. The behaviour of the blood-pressure in secondary wound shock is also charted diagrammatically.



Primary wound shock curves (diagrammatic). Following a severe anatomical injury, instant wound shock may develop, which may be fatal in a shorter or longer time, as shown at A or A[1]. Under favourable circumstances the pressure may rise to B, dropping later to C. At this point the primary has merged into secondary wound shock.



Secondary shock curves (diagrammatic). In many of the cases of moderately severe wounds the pressure will remain level at A. In others it falls with the establishment of secondary wound shock, B. At this point the patient may react quickly to treatment, C, or after more prolonged treatment at D, to E. In the absence of favourable circumstances, the pressure goes steadily down, and the case terminates fatally in from 12-24 hours, F.

FIG. 4.

(Reproduced by permission of the *Lancet*).

Aggravation of Wound Shock by Surgical Operation and other Factors.

Marshall has published records of the blood-pressure in the wounded during operation. Here are a few illustrations from my own cases.

(*a*) This patient came into hospital within twenty hours of receiving a gun-shot wound with fracture of the right fibula. On admission the maximum pressure was 130, which fell to 120 at the end of the first

operation. Next day gas gangrene developed, necessitating the amputation of the limb. After operation the pressure had fallen to 80. It was recognized that the cause of toxæmia was now removed, and that there was no hæmorrhage to treat. The patient was kept warm, given plenty of fluids, and in a few hours the blood-pressure had completely regained its former level.

(*b*) S. Major —— was admitted twelve hours after sustaining a shell wound of the thigh. At the operation the fragment was found to have torn the femoral vein, and the patient lost a certain amount of blood before the vein could be sufficiently exposed to be sutured.

The pressure fell from 118 to 90 millimetres, and in this case was immediately restored by an intravenous injection of gum saline. Fifteen hours later the shock-like condition, so often associated with the presence of gas gangrene infection, was observed. This necessitated excision of the affected muscle (sartorius), and a further intravenous injection of the gum saline. The blood-pressure was thereby restored and the man recovered.

(*c*) During operation in gunshot wounds of the abdomen a fall of blood-pressure may be produced by one of three conditions, as Marshall has pointed out: (1) Manipulation of gut or omentum outside the abdominal cavity; (2) occurrence of copious hæmorrhage; (3) change of posture at the end of operation from dorsal to lateral.

Summary of Front Line Clinical Observations.

From these clinical studies, the factors which predominate in the pathogenesis of wound shock appear to be:—

(1) Pre-wound factors of fatigue, exposure, lack of water, loss of bodily fluid, and presence of excitement.

(2) Post-wound factors of pain, hæmorrhage, cold, and absorption of bacterial or tissue toxins.

V.—Pathology of the Circulation in Shock.

(*a*) *The Quantity of Fluid Circulating in the Vascular System is Diminished.*

In the spring of 1918, N. M. Keith [6] and O. H. Robertson [7], measured the blood volume directly by the vital red method, in thirty cases of shock. In cases with distinct symptoms of shock the blood volume ranged from fifty-one to eighty-five per cent of the normal, while there was a corresponding reduction of the plasma. In one striking fatal case this loss of blood volume occurred without any hæmorrhage whatever having occurred.

From these studies Keith makes a clinical division of shock cases into three groups:—

(1) *Compensated*, where beyond pallor, weakness, and a slightly

quickened pulse, the general condition is good, the blood-pressure remains above 100, and the blood-volume is never reduced below eighty per cent.

(2) *Partially compensated cases*, where the general condition is not good. There is usually a history of a smart hæmorrhage. The man is pale, restless, thirsty and readily vomits. He is cold, with a rapid pulse and the blood-pressure is usually seventy to eighty millimetres. The blood volume ranges been sixty-five to seventy-five per cent.

(3) *Uncompensated cases*, where the condition is extremely serious. The symptoms are even more pronounced than in (2), and the pressure has fallen below sixty millimetres Hg. On auscultation the heart rate is 120-160. The blood-volume is below sixty-five per cent of the normal.

In normal men the loss of even as much as 800 cubic centimetres of blood is followed by a quick return to the original volume. In shock this compensation fails to occur. This may be due to an anhydræmic condition of the tissues produced by diminished intake of fluids, owing to stress of Service conditions and extra loss of fluid, violent bodily exertion, and sweating from various causes.

(*b*) *The Concentration of Blood is Increased and Capillary Stasis is Present.*

Cannon and others found abundant evidence of concentration of blood in the capillaries, by making blood-counts, observations on the hæmoglobin percentage and hæmatocrit readings. Even after hæmorrhage, if separate blood-counts of blood taken from a vein and from capillaries be compared, a discrepancy is found. In both counts the number of corpuscles is diminished, but more so in the veins. This capillary concentration is regarded as being due to increased permeability of the capillary endothelium. Its exact mechanism, however, is not yet clear. As a result of this concentration the viscosity of the blood is increased, the capillary stasis still further encouraged, and a vicious circle is established.

Leonard Hill and McQueen [8] have studied the capillary circulation and especially stasis. They state the primary cause of this condition is the fall of blood-pressure below eighty millimetres Hg, and the fact that the fall is not temporary, as in fainting. As the result of this stasis, de-oxygenation of the capillary areas follows. The osmotic pressure of the tissues rises, abstracting fluid from the capillaries. The capillary wall suffers and becomes more permeable, and so the viscosity of the concentrated blood progressively increases.

(*c*) *Results of this Failure of Circulation.*

Starling, in 1912, found that with a blood-pressure below eighty millimetres Hg, the cardiac output is diminished.

This is due to the diminished rate of capillary circulation in the cardiac muscle. The cells of the whole body suffer in the same way, owing to the deficient intracellular oxidation.

It may be argued that the changes described in the cells of the central nervous system in fatal cases of shock are not the cause, but the result of this process. Cannon regards a blood-pressure of eighty millimetres Hg as the critical level. A case where the pressure remains below this level for more than four hours will not recover, no matter how heroic are the measures of treatment employed.

The diminution of intracellular oxygenation, which is associated with the low body temperatures found in shock, is now combated by the injection of insulin, which will be referred to later.

(*d*) *Older Theories as to the Circulatory Failure in Shock.*

The "splanchnic pool" no longer exists. Observed facts have supplanted fantastic hypotheses, and such methods of treatment as the pneumatic suit or raising the foot of the bed are now obsolete.

VI.—Toxæmic Factors in Shock.

Clinical evidence for the support of the adrenalin theory has already been produced.

Experimentally, Cannon, and also Elliott, have demonstrated the presence of adrenalin in the circulating blood of animals under emotional stress. Bedford has been able to show the presence of adrenalin in the blood of animals suffering from experimental shock. Bainbridge and Trevan found that intravenous injection of small doses of adrenalin into an animal after twenty minutes induces the same concentration of the blood already described.

Dale's "histamine shock" opens up a large field of thought. Dale and his co-workers found that suitable doses of histamine (ten milligrammes for a large cat) produce a profound drop in blood-pressure, with capillary stasis and subsequent concentration of the circulating bloods. Smaller doses produce a vasodilatation, for which evidence is produced to show that it is capillary in origin. This work deserves consideration in conjunction with Bayliss's investigations on muscle trauma. Bayliss and Cannon found that within an hour after producing a compound fracture of the femur in an anæsthetized cat signs appeared similar to those seen in secondary wound shock. The pressure gradually went down, pulse-rate and respiration increased, the blood became concentrated, and finally the animal died. This occurred just as rapidly when the limb was isolated from the central nervous system; so that the possibility of its being due to the transmission of harmful afferent stimuli was negatived. When, however, the returning blood-stream was interrupted, no lowering of the pressure resulted, and the animal remained in good condition until the clips on the vessels were removed. As soon as the returning blood from the traumatized area reached the general circulation, down came the blood-pressure. It is probable that some tissue poison is set free from the traumatic myolysis which has resulted, producing effects like histamine.

The importance of the toxæmic factor in shock is now becoming more widely recognized than ever before. Several Continental workers have published works on this subject. Cornioley and Kotzareff [9], in 1921, found that: (*a*) The more marked the anatomical lesion the more prolonged is the shock, and (*b*) the more massive the toxæmia the shorter is the incidence of shock. Quenu [10] found that blood taken from a shocked animal always induces shock when injected into a fresh one, producing rigors, lowering of body temperature, coma, etc. In further experiments these workers claim to have prevented shock by injecting animals with

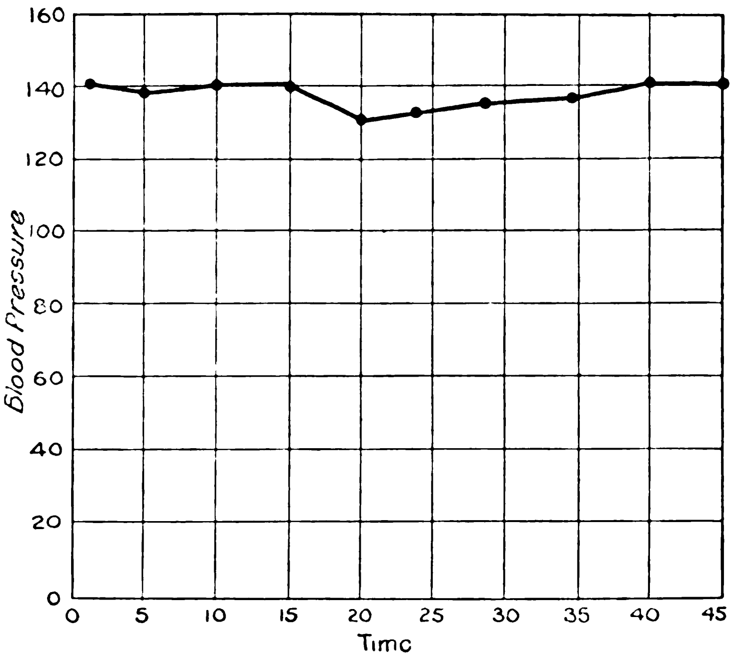


FIG. 5.—Fore-quarter amputation.

small doses of shocked blood. On the clinical side it is stated the phenomena of toxic shock arise in the following order of frequency: (1) Fracture of bones, (2) burns, (3) fatigue, (4) malignant tumours.

Quenu [11], from his clinical studies, also classifies shock into primary and secondary.

De Courcy [12] in 1922 accepts the idea of secondary shock, and considers those reactions that follow in from twelve to twenty-four hours as coming under this category. He thinks that the main factor is the absorption of toxins produced by destruction of tissues in rough manipulation. To combat this effect he attempts to desensitize the patient before operation by injecting typhoid vaccine, and claims success for his method.

Further proof of toxæmia in shock has been obtained experimentally by taking two animals and crossing the circulation. Induction of shock in one animal leads to a corresponding fall of blood-pressure in the other (McIver and Haggart [13]).

On the clinical side there is ample evidence in favour of the toxic factor in shock. Several cases have already been quoted where the presence of toxæmia, either tissue or bacterial in origin, has been the potent cause of shock. If this absorption of toxin idea is true, a clear indication is afforded as to the prevention of shock in surgical procedures. This is well illustrated by the following case:—

Two years ago I performed a fore-quarter amputation of the right upper limb in an old lady of 72 for sarcoma of the upper end of the humerus.

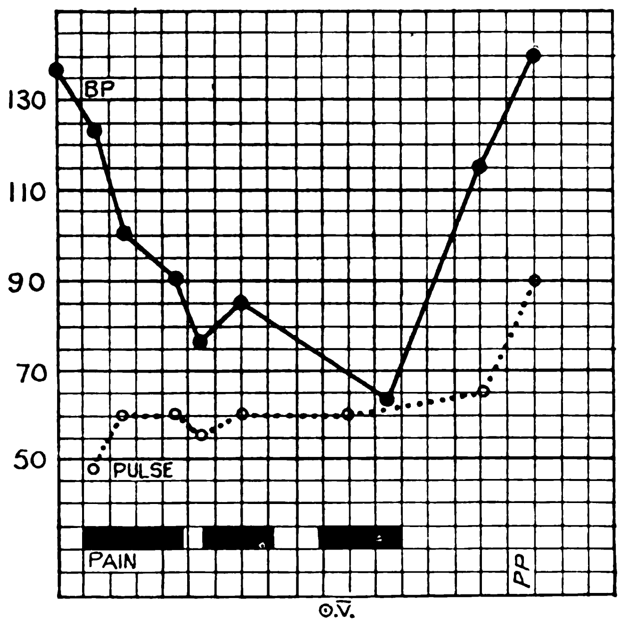


FIG. 6.—Acute renal colic.

The main vessels were exposed and clamped at the commencement of the operation. The unblocked brachial plexus was left intact, and was undivided until half an hour later, when the limb was finally removed. The blood-pressure remained constant (fig. 5), and no shock developed subsequently. Afferent impulses may be therefore considered as harmless as long as the higher nerve centres are cut off as in surgical anæsthesia. Pain itself produces a fall in blood-pressure. Reference to fig. 6 shows the fall in blood-pressure from 135 to 65 in about an hour and a half during attacks of acute renal colic. When the pain was relieved by morphia the pressure quickly rose to normal.

Bacterial toxæmia, supervening in a few hours after a wound or surgical operation, exerts a profound influence on the blood-pressure with the establishment of secondary shock.

If an unsuitable anæsthetic is employed, a chemical toxæmia may be added to the shock causation complex with serious results.

Chloroform, and to a lesser extent ether, are powerful toxic agents. Buckmaster many years ago pointed out that the presence of chloroform in the blood greatly diminished the oxygen-carrying power of the red corpuscle, thus aggravating the already present deficient tissue oxygenation.

M. K. Cattell [14], in 1923, working in Cannon's laboratory, published the results of extensive studies of the blood-pressure in ether anæsthesia. Some of the more important conclusions are :—

(1) In the normal animal strong ether inhalation results in a sudden temporary drop of blood-pressure. The pressure recovers quickly, so that it is normal by the time the eye reflex has gone.

(2) In the shocked animal there is no recovery after the primary fall. The pressure continues to fall even to zero as the anæsthesia is continued.

(3) Nitrous oxide and oxygen can be given to a shocked animal with only a minimal drop in blood-pressure.

(4) (No. 9 on Cattell's list.) Ether sensitiveness is induced by (1) low blood-pressure, (2) hæmorrhage, (3) severe operations, (4) injection of acid.

These observations on ether and shock confirm the opinion surgeons now hold on the value of gas and oxygen anæsthesia. In shock and severe operations where shock is expected to occur, it is absolutely unjustifiable to give any general anæsthetic other than gas and oxygen.

Recognition of the tissue toxæmia occurring in shock establishes the relationship of surgical shock to anaphylactic shock.

It is convenient here to discuss the effect of morphia in shock as an additional toxic factor. The beneficial effect of small doses of morphia, which may be repeated, has already been shown. Large doses slow respiration, produce cyanosis, lessen the intake of oxygen and diminish the already failing intracellular oxygenation of the tissues. At one time CO_2 was thought to be beneficial in shock (acapnia theory). Cyanosis should always be regarded as a dangerous condition and avoided or actively combated on all occasions.

VII.—The Central Nervous System.

The earlier views on the pathology of shock all centred round the nervous system. Exhaustion of the vasomotor centre, fatigue of the higher centres, peripheral vasoconstriction and splanchnic dilatation were each in turn discussed, as the essential factor.

Little will be said here of the nervous side of the subject. From the

practical point of view excitement, fatigue and anxiety must be dealt with, and steps taken to relieve pain. Otherwise the nervous theories of shock may be kept for academic and historical discussion only.

VIII.—Metabolism in Shock.

In this connexion the work of D. Fisher [15], of Boston, is interesting and of great practical importance. He classifies shock into four groups: (1) Traumatic, (2) septic or toxic, (3) anaphylactic, (4) nervous. Studies of the blood-sugar after a Marathon race showed that it is normal where no distress is present. In one runner, who fell unconscious, a low blood-sugar content was found, the picture of an overdose of insulin. Fisher conceives shock as a condition where there is an internal asphyxia and acidosis with oxidative processes held in abeyance, producing the resulting exhaustion. Any method of promoting combustion and oxidation and at the same time furnishing heat energy, should be effective. Therefore, to combat shock rationally, give a substance that will give rise to an immediate supply of energy, maintain it and at the same time keep up the circulating volume. For this purpose he uses insulin combined with hypertonic glucose solution.

The following cases of Fisher's are quoted as examples of this treatment:

Case 1.—*Surgical Shock.*—H. A., male, aged 25, was submitted to an arthrodesis of the shoulder-joint for tubercular disease. The operation lasted two and a half hours. His pulse increased from 96 to 150, the respiration from 18 to 35, and his blood-pressure fell to 75. On return to bed he was pulseless with respirations of forty. A litre of 10 per cent. glucose was slowly given intravenously. Insulin was injected subcutaneously at the beginning and end of the infusion, twenty-five units each time. The reaction was almost miraculous. Two hours later the pulse was 116, respiration 22 and blood-pressure 112. Acetonuria was present, but had disappeared eight hours later.

Case 2.—*Toxic Shock.*—A lady, aged 64, became shocked twenty-four hours after an operation for a gangrenous gall bladder. Her temperature was 104, pulse 140, and respirations 36. A litre of glucose was given slowly for two and a quarter hours with insulin, as in Case 1. Six hours later her pulse was 108, temperature 102, and respirations 22, and her subsequent convalescence was straightforward.

Other cases are quoted and other observers have obtained similar results. Fisher states there is no danger as long as there is glucose in the urine. To counteract an insulin reaction, the juice of an orange, or cane sugar may be given with or without a hypodermic injection of adrenalin. He also advises rectal saline to be given at the same time.

Acidosis was considered an important pathological factor at one time. It is now recognized to be the result and not the cause of a low arterial level. Acidosis disappears as the pressure rises.

IX.—Present Conception of the Pathology of Shock.

Shock may be divided into primary and secondary varieties :—

Initiating factors are :—

(1) Pain.

(2) Hæmorrhage.

(3) Cold.

(4) Toxæmia : tissue, bacterial

(5) Anaphylaxis.

Sustaining factors are :—

(1) The low blood-pressure.

(2) The decreasing blood-volume.

The results produced are :—

Diminished circulating fluid.

Deficient intracellular oxygenation.

Devitalization of important organs, as heart, brain, kidneys, &c.

X.—Treatment.

The more exact our knowledge becomes concerning a given pathological condition, the simpler and more successful the treatment. The conception of secondary shock led to the adoption of measures for its prevention. Such front line measures, which are published in the Army Medical Manuals and taught to-day in the R.A.M.C., are familiar to all present. In surgical centres the importance of the organization of pre-operation and resuscitation wards, is admitted by all. In civilian first-aid work to-day the same principles of efficient first-aid and splinting, administration of warmth and fluid, and rapid evacuation to hospital, are being taught everywhere.

In the operating theatre shock may be avoided by warmth, choice of suitable anæsthetic, i.e., local, spinal, or gas and oxygen for a bad case, hæmostasis and gentleness in handling the tissues.

Starving the patient and withholding fluids too long beforehand tends to anhydræmia and is to be avoided. A small dose of morphia may allay undue mental pre-operative apprehension.

In the wards the same general principles again apply. If shock develops and a blood-pressure of 80 millimetres Hg does not respond to simple measures within half an hour, then give a litre of 10 per cent glucose saline with insulin at the beginning and end of the infusion. Even after a severe hæmorrhage this will tide the patient over the crisis, and infusion of whole blood (transfusion) may be done subsequently if necessary.

The question of operating in shock must be decided in each case. If a suitable anæsthetic is employed, surgery may be the only means of removing the cause of toxæmia and thereby saving the patient.

Summary.

I. *Shock* may be defined as: The clinical condition which follows an injury, producing depressed vitality, associated with lowered blood-pressure, deficient circulating fluid, diminished intracellular oxygenation and reduced body temperature.

Such a condition results from the presence of one or more of the following four factors, acting either singly or in combination: (1) Pain; (2) hæmorrhage; (3) cold; (4) toxæmia, either of bacterial tissue or other origin.

II. *Secondary traumatic shock* is the common type and only becomes established slowly.

III. *Prevention is successful* in many cases, even under front line conditions and in war surgery.

IV. *Treatment of an Established Case*:—

(1) Application of warmth and mental rest.
(2) Relief of pain.
(3) Restoration of deficient circulation, giving fluid by mouth, rectally, or 10 per cent glucose saline solution intravenously. One litre in two hours.
(4) Increase of deficient intracellular oxygenation by insulin hyperdermically. Five units at beginning and end of glucose injection.
(5) If operation is needed—by choosing a local, or gas and oxygen anæsthesia.

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YET ANOTHER APPRECIATION.

By Colonel H. S. ROCH, C.M.G., C.B.E., D.S.O.

and

Major A. L. FOSTER.

Royal Army Medical Corps.

A medical staff exercise was recently held near Lahore for the instruction of majors in the district who have not yet passed the examination for promotion to lieutenant-colonel.

Appreciations were submitted by every British military hospital in the district, and one was also written in the A.D.M.S.'s office. After the last conference some of the candidates suggested that the latter appreciation might be useful to other officers reading for promotion, as it was "different to those previously published." This suggestion, and the hope that it may lead to useful criticism, are our apologies for sending the following notes, general and special ideas, narrative and appreciation to the Journal.

(1) Experience at examinations of majors, R.A.M.C., for promotion to lieutenant-colonel has shown that candidates have considerable difficulty in writing an appreciation of a situation from its medical and hygienic aspects. This is probably because instructions concerning writing "appreciations" are made for the combatant branches, and it is impossible to adapt them accurately to the work of the medical service. From the medical point of view an "appreciation" is a medical and sanitary report on the situation. Appreciations are generally too long and contain too much unnecessary detail.

If the writer will bear continually in mind the following two points, and use his imagination, the commonest faults should be avoided.

First. The appreciation is written for the information of the G.O.C. of a force, at a time when he is overwhelmed with work, and is receiving appreciations from the heads of every branch of his army. The medical appreciations should be written with the idea of relieving him from worry concerning his casualties and of concisely informing him, and his staff, of the likely causes, amount and effects of sickness in his troops, what plans are made (or proposed) to diminish wastage, and for the collection, distribution, evacuation and treatment of sick and wounded, and whether the accommodation, transport, medical and surgical supplies, etc., are adequate, if not what additions are considered necessary. Tables showing how results are arrived at should be shown in appendices; the staff can read these if they doubt the findings, and these are necessary to support statements, suggestions or demands made in the body of the appreciation.

Second. We are all mortal. Should the writer suddenly drop down dead, his successor, a stranger, should be able to understand the situation

and carry out the original policy by reading his predecessor's "appreciations."

LAHORE DISTRICT: MEDICAL STAFF EXERCISE, JANUARY 10 AND 11, 1928.

Reference Punjab Sheets 44, I 7, 44, I 8, *and* 44, I 12.

General Ideas.

(1) Ravia and Sutlia are independent civilized states with armies organized and equipped on the same lines as the British army. The composition and peace distribution of the Ravia force are given in Appendix I. Sutlia army is of about equal strength.

(2) The tract of country between Sutlej and the Thaman distributary (Sheet 44, I 8), chief town Kasur, is inhabited by a mixed population, partly of Ravian and partly of Sutlian origin. Its ownership has been in dispute for many years, and has been referred to the League of Nations, which is expected to give its decision on January 31, 1928. Pending its decision, the League of Nations has ordered all troops to be withdrawn to their peace stations and has forbidden both states to mobilize or move troops.

Note I.—Ravia consists of all the Punjab north of Ferozepore and Multan; between Lahore and Ferozepore the actual frontier follows the Bari Doab Canal.

Composition and Peace Distribution of Ravia Field Army.

General Headquarters and No. 2 (Army Co-operation) Sqdn.	Gujranwala.
1st Cavalry Brigade and No. 1 Cavalry Field Ambulance	Sialkot.
1st Division	Wazirabad and Gujrat.
2nd Division	Gujranwala.
Sec. 7th (A. C.) Coy. (attd. 1st Cav. Bde.) ...	Sialkot.

Covering Troops—

7th Inf. Bde.	2nd Battn. York and Lancaster Regt. 2nd Battn., the Seaforth Highlanders 2nd Battn., the Durham Light Infantry 1st Battn., the Black Watch (R.H.)	Lahore.
12th Field Brigade, R.A. (less two batteries) ...		Lahore.
No. 7 Field Ambulance		Lahore.

The above are kept fully equipped with 1st L.T., and a proportion of the Divn. Train and D.A.C.

Medical Units—Ravia Force.

The following medical units for L. of C. and base have been mobilized:—

Nos. 1, 2 and 3 C.C.S.
Nos. 1 and 2 M.A.C.
Nos. 1 and 2 Sanitary Sections, L. of C.
Nos. 1, 3 and 5 General Hospitals—each 1,200 beds.
Nos. 2, 4 and 6 General Hospitals—each 600 beds.
No. 1 Mobile Hygiene Laboratory.
No. 1 Mobile Bacteriological Laboratory.
Nos. 1, 2 and 3 Ambulance Trains.
No. 1, Base Depot Medical Stores.
No. 1 Advanced Depot Medical Stores.
No. 1 Ambulance Car Company.
A and B Convalescent Depots.

L. of C. troops and base units number about 16,600.

SPECIAL IDEA (RAVIA FORCE COMMANDER ONLY).

At 14.00 hours on December 30, 1927, the Commander-in-Chief, Ravia, visits Lahore and gives the Officer Commanding the following instructions:—

"The decision of the League of Nations is expected to be against Ravia, and the Government has decided to seize Kasur. Our latest information is that Sutlia is unprepared and will take no action beyond diplomatic protests.

"My plan is to rail the 1st Cavalry Brigade (less one regiment) and the 1st and 2nd Divisions to Lahore and march them to Kasur. Detrainment at Lahore will commence about noon on January 2. 4th Hussars and one section 7th (A.C.) Company have been placed under your orders and will reach Lahore by road. The former on evening of December 31, and the latter on morning of January 1.

"One flight of No. 2 Squadron, R.A.F., will be allotted to you. They will reach Lahore on evening of December 30, and report to you by 19.00 hours. You will move the Lahore Garrison to Khana on 31st and advance on Kasur as soon as the cavalry and armoured cars join you on January 1 about 08.00 hours. You will capture Kasur at all costs and maintain yourself there."

The 1st Cavalry Brigade and 1st and 2nd Divisions will concentrate at Lahore with a view to advancing on Ferozepore.

Supply railhead: Lahore.
Base: Rawalpindi.

NARRATIVE I.

By morning of December 30, the 7th Infantry Brigade, 12th Field Brigade, R.A. (less two batteries), and No. 7 Field Ambulance have been mobilized, and are in all respects ready to move at short notice.

The 4th Hussars and one section Armoured Car Company are moving

by road from Sialkot to Lahore, where they expect to arrive on the evening of December 31, and morning January 1, respectively.

The Cavalry Brigade and 1st and 2nd Divisions are mobilizing and should be concentrated at Lahore and ready to move by January 3.

Problem No. 1.—As D.M.S. on evening December 30, write an appreciation of the situation for the information of the General Officer, Commanding-in-Chief, Ravian Force.

Note.—The appreciation must include your proposed disposition of the L. of C. and Base Medical Units of the Force

Appreciation of the Medical Situation.

By Major-General , D.M.S.

(Ravia Force, written at Gujranwala, on December 30, 1927.)

Map references Punjab Sheet 44, I 7, 44, I 8, 44, I 12.
Punjab 16 *miles to* 1 *inch.*

(1) *Conditions Affecting Health of the Troops.*

Until May, at any rate, epidemic of disease need be no longer anticipated.

The troops have been inoculated against enteric, and are well protected against small-pox.

Arrangements have been made for efficient chlorination of water, and the sanitary arrangements for the force are sufficient.

Civilian sweepers have been enrolled and attached to the L. of C. sanitary sections to ensure efficient conservancy on L. of C. on base.

Arrangements have been made with "Q" Branch for provision of baths and washing and disinfecting the men's clothing.

Arrangements have been made with the Pasteur Institute, Lahore, to treat cases of dog bite occurring among troops.

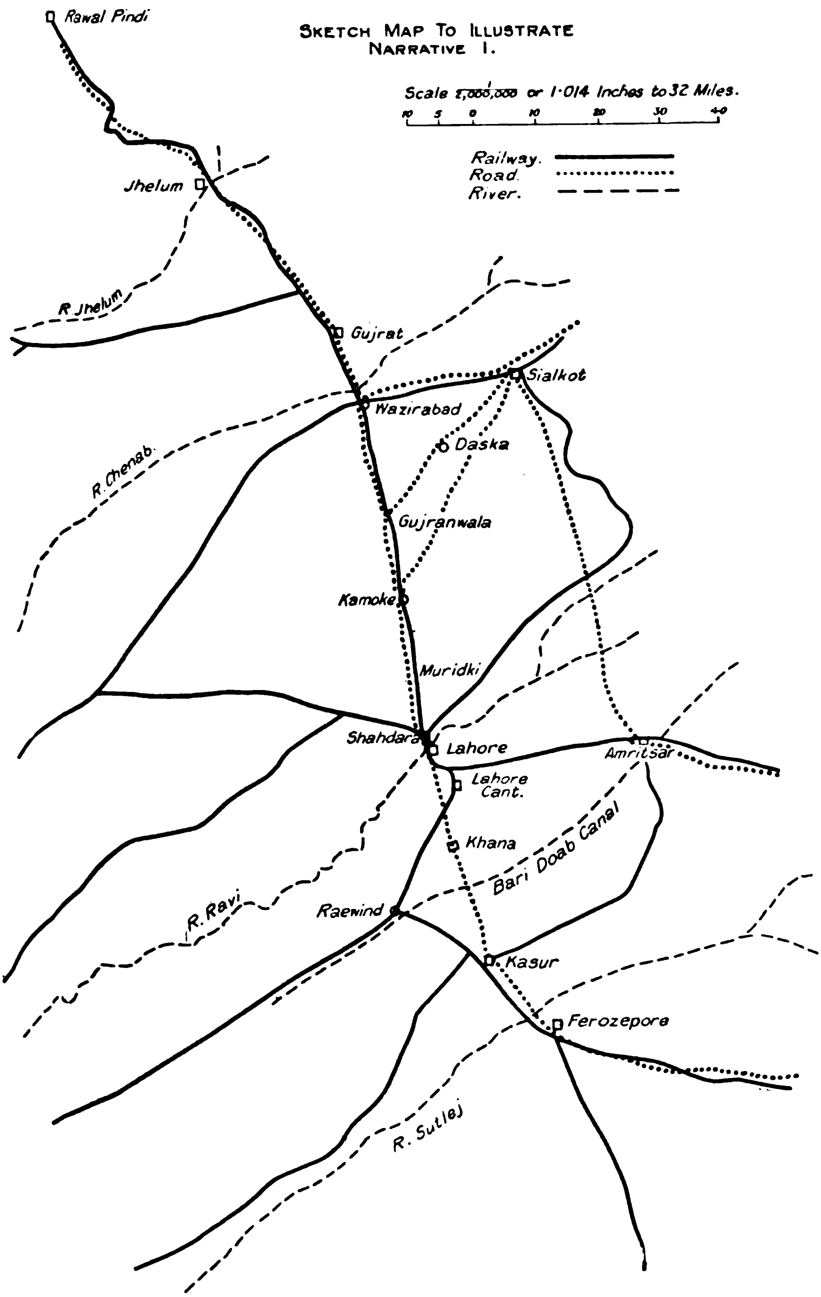
Owing to cold nights the normal one blanket and greatcoat is not considered sufficient protection and a second blanket should be provided. It has been arranged that serge clothing will be worn.

If poison gas is used, field ambulances and casualty clearing stations should each hold an extra 100 sets of clothing and 100 pyjamas.

(2) (*a*) *Sick.*

Assuming the above conditions, and taking strength of force at 58,000, the normal daily sick wastage, apart from battle casualties, should be about 180 daily. Of these, sixty per cent, i.e., 110, require to be evacuated from the field army. The majority will be fit to return to duty or will be invalided in a month, so that 2,000 beds will be permanently occupied in base or L. of C. units (see Appendix I).

(*b*) *Wounded.*—The estimated battle casualties to be dealt with are


SKETCH MAP TO ILLUSTRATE
NARRATIVE I.
Scale 1/1,000,000 or 1·014 Inches to 32 Miles.
10 5 0 10 20 30 40
Railway.
Road.
River.
Rawal Pindi
Jhelum
R. Jhelum
Gujrat
Sialkot
Wazirabad
Daska
R. Chenab.
Gujranwala
Kamoke
Muridki
Shahdara
Lahore
Amritsar
Lahore Cant.
Khana
Bari Doab Canal
Raewind
R. Ravi
Kasur
Ferozepore
R. Sutlej

5,600 (see Appendix II) based on an estimate of 20 per cent of three-fifths of the total force. This is considered high enough to allow for wounded, prisoners of war and refugees.

As the enemy are unprepared these are not likely to occur immediately.

(3) *Collection and Evacuation of Sick and Wounded.*

A. Divisional medical units are sufficient to deal with sick and wounded of the Division and Cavalry Brigade, but it is recommended that the heavy horsed ambulance wagons be replaced by light (Mark I) ambulance wagons on account of the bad condition of the country tracks off the main road.

B. *Casualty Clearing Station.*—No. 1 C.C.S. will be sited at Lahore Cantt. near Railway Station on January 2, open. Nos. 2 and 3 C.C.S. will arrive at Lahore on January 3. No. 2 will open at once and No. 3 remain closed.

Mobile Sections of Nos. 2 and 3 will be held ready to move at very short notice.

This is sufficient accommodation for the sick of the force up to the evening of January 3.

C. *Motor Ambulance Convoys.*—No. 1 and 2 M.A.C. are located at Lahore by January 1.

The evacuation of casualties from the Lahore Garrison attacking Kasur on January 2 will present no difficulties.

In further fighting up to the extent of a division engaged, casualties up to 10 per cent. can be evacuated from Kasur by M.A.C. in twenty-four hours without other assistance.

Should the two divisions be engaged at the same time with the same percentage of casualties, other motor transport to carry 1,000 cases will be required to complete the evacuation in the same time (see Appendix III).

D. *Ambulance Train.*—There are three ambulance trains available and these should be sufficient to deal with all casualties. They can move 1,500 patients from C.C.S.'s to general hospitals every forty-eight hours (see Appendix IV).

(4) *Accommodation on L. of C. and Base.*

A. There are six general hospitals with 5,400 beds expandible to 6,500 beds. These are located No. 2, at Lahore, 600 beds ; Nos. 5 and 6, Sialkot, 1,800 ; Nos. 1, 3 and 4, Rawalpindi, 3,000 beds. There are thus 1,100 beds less than the estimated total casualties sick and wounded. One additional 1,200-bedded general hospital should be asked for.

B. Convalescent depots have been opened at Rawalpindi and Sialkot.

The Indian Red Cross have promised to provide gifts, comforts and invalid clothing for patients in hospitals and to make arrangements for the temporary care of invalids and convalescents not requiring further active treatment and to look after casualties among refugees.

Recommendations.

(1) The issue of one extra blanket to each man, with necessary transport.

(2) The replacement of heavy ambulance wagons (Mark VI) by light ambulance wagons (Mark I) with field ambulances.

(3) The provision of one extra general hospital (1,200 beds).

(4) One thirty-hundredweight lorry containing eighty blankets and eighty stretchers to be attached to each divisional field ambulance.

(5) Each C.C.S. to be provided with 200 blankets and stretchers to form a dump and replace equipment brought from field ambulances.

(6) One consulting surgeon and one consulting physician to be attached to the force.

Appendix I.

Sick—

Strength of Force	58,000
Daily average sick wastage is 0·3 per cent, i.e. about	180
Of these 60 per cent require to be evacuated—about	110

Therefore: at the end of 7 days ... 770 have been admitted in hospital.
" 14 " ... 1,540 " " "
" 21 " ... 2,310 " " "

Between fourteen and twenty-one days as many will be discharged as admitted, therefore 2,000 beds may be taken as sufficient for sick.

Note.—The actual sick rate, excepting mild cases of sore feet during the recent Kasur manœuvres, was 1·8 per 1,000.

Appendix II.

Total Force	58,000
Three-fifths of Force are engaged, i.e.	34,800
20 per cent of these are casualties, i.e.	7,000
Of these 20 per cent are killed or missing, or do not require hospital accommodation, i.e.	1,400
Therefore accommodation required	5,600 beds.
Available beds	5,400 "
Required for sick	2,000 "
Available for wounded	3,400 "
Therefore additional beds required	2,200 "
Arranged for by expansion	1,100 "
To be provided	1,100 "

i.e., one 1,200 bedded general hospital.

Appendix III.

Casualties of a Division with moderate Resistance.

10 per cent of three-fifths of 17,000	1,000
Less 20 per cent not requiring evacuation ...	800
Sitting	480
Lying	320

Each car can carry four lying or six sitting.

This number therefore requires 160 round trips.

Two M.A.C.'s contain 150 cars less 10 per cent, i.e. ... 135

Return trip will take eight hours running time allowing for loading, etc., four hours = twelve hours return journey.

Therefore all casualties can be cleared within twenty-four hours.

Appendix IV.

Two Ambulance Trains at Lahore, on January 3.

Return trip to Rawalpindi, including twelve hours delay at Rawalpindi ... ... 54 hours

Return trip to Sialkot, including eight hours delay at Sialkot 24 „

			dep. Lahore		Carries		arr. Lahore
To Rawalpindi,	Jan. 3,	A	01.00 hrs.	...	500	...	07.00 hrs., Jan. 5
„ Sialkot	„ 3,	B	06.00 „	...	500	...	06.00 „ „ 4
„ Rawalpindi,	„ 4,	C	01.00 „	...	500	...	07.00 „ „ 6
„ Sialkot	„ 4,	B	08.00 „	...	500	...	08.00 „ „ 5

On January 5, A and B trains can be in Lahore ready to move another 1,000 patients.

On January 6, C train can also be ready in Lahore.

Appendix V.

Sites of medical units on midnight, January 3 *to* 4.

C.C.S.: Nos. 1 and 2 open at Lahore Cantonment, No. 3 (less Mobile Section) on train at Lahore Cantonment.

M.A.C.: Nos. 1 and 2 at Lahore.

Sanitary Sections: Headquarters No. 1, Lahore; Headquarters No. 2, Rawalpindi; supplying detachments for railway and Sialkot.

General Hospitals: No. 2[1], at Lahore, Nos. 1, 3[2] and 4[3] at Rawalpindi; Nos. 5 and 6 at Sialkot.

Mobile Hygiene Laboratory: Lahore.

Mobile Bacteriological Laboratory: Lahore.

Ambulance Trains: See Appendix IV.

No. 1, B.D.M.S.: Rawalpindi.

No. 1, A.D.M.S.: Lahore.

One Auxiliary Ambulance Car Company.

Headquarters: One Section, Rawalpindi; one Section, Sialkot.

Convalescent Depot: A at Rawalpindi; B at Sialkot.

[1] Including accommodation for self-inflicted wounds.

[2] Includes accommodation for sick Sisters.

[3] Infectious and venereal.

VOLUNTARY AID: A SYMPOSIUM.

I.—INTRODUCTION.

By Major A. C. AMY, D.S.O.

Royal Army Medical Corps.

There was a time when I thought that the information contained in F.S.R., Vol. I, Chapter XXII, pp. 193-194, and in R.A.M.C. Training, Chapter XXI, was all I need learn about voluntary aid.

I was wrong.

Suddenly and unexpectedly I found myself involved in voluntary aid activities as an instructor, inspector, examiner and administrator; and such an experience is liable to befall any officer of our Corps. Hence we should know more about the business than F.S.R. and R.A.M.C. Training tell us—that is, if we wish to take an intelligent interest in the work, and to enlist the sympathy and co-operation of Voluntary Aid for the benefit of the Service.

The two publications referred to above set down the barest essentials concerning a big and growing subject. From them we imbibe little more than the titles of certain organizations—the Order of St. John of Jerusalem, the British Red Cross Society and St. Andrew's Ambulance Association; and of the body which co-ordinates the activities of these organizations and links them up with the Army Council—the Central Joint Voluntary Aid Detachment Council.

Of course there is a voluminous voluntary aid literature, lay and professional, official and unofficial; but, unless you intend to specialize in the subject, you need not spend much time over book work. First of all read, mark, learn and inwardly digest the valuable and illuminating material contained in Chapter XI of the Official History of the Great War, Medical Services, General History, Vol. I. Secondly, master the contents of a small pamphlet entitled "General and Training Regulations for Voluntary Aid Detachments." Having done that, you will be able to perform your duties with understanding and circumspection.

At the outset it is well to remember that British voluntary aid is conducted in a typically British way.

We are a nation of unions, leagues, associations, societies, commissions, committees and clubs.

Where one organization would meet the case we must have two, three or more.

Thus, in order to look after the children we found the N.S.P.C.C., the Waifs and Strays Society and the A.O.F.B.; for the protection of animals we turn to the R.S.P.C.A., Our Dumb Friends' League and numerous

other organizations of the kind. For the Church Militant there is the Boys' Brigade, the Church Lads' Brigade, the Salvation Army and the Church Army. For various "benefits"—including bottles of medicine and coffins—there are the Foresters, the Buffaloes and the Oddfellows. For the old soldier there is the British Legion, the Old Contemptibles and the Ypres League; and, for no reason at all, we call ourselves Conservatives, Liberals or Socialists.

When we get down to bedrock we discover that all organizations in the same class have the same aims and objects, such as the advancement of religion or humanity, or good government in the best interests of the country. Under certain circumstances, usually of stress, the members of these organizations make the same discovery and band themselves together under a common direction. In this way the Friendly Societies unite in face of attacks from the B.M.A. or the Ministry of Health; or a Parliamentary Coalition is formed in a time of grave national danger. On such occasions these innumerable leagues, societies and clubs act in a logical manner; at all other times their conduct is a puzzle to anyone but an Englishman. A Frenchman studying the phenomenon would shrug his shoulders, say, "*Plus ça change, plus c'est la même chose,*" and give it up as a bad job; but we know that one society was founded in 899 and the other in 1899, that the originator of the third was Lord Browne, of Bastionwickham, and of the fourth, Charles Chump, Esq., of Clapham, that the fifth society possesses £1,000 and the sixth £10 only . . . . these things we hear sometimes publicly, sometimes privately, according to the circumstances, prejudices or rancours of the case.

How could they enrol themselves under the same banner?

So long as our national characteristics endure, the thing is impossible.

That being the case, it is obvious that "Safety First" is indicated and, to this end, I think I have found a secure standpoint which I commend to those who have to deal with this branch of our work.

Regard Voluntary Aid as the Territorial Army (V.A.), composed of the regiments of St. John, St. Andrew and the Red Cross. These regiments are divided into numerous detachments which are scattered throughout grouped county areas. Administration and control are on a county basis.

The three regiments differ from each other in details of uniform; and each has its own peculiar history, outlook and traditions. To you these differences are only of academic interest: your real concern is in the work, objects and aims of voluntary aid as a whole and—from your point of view—the work, objects and aims of the three regiments are identical.

Regard the Central Joint V.A.D. Council as G.H.Q. of the T.A. (V.A.).

In taking up this position you will avoid making any *faux pas*, and you will keep clear of any suspicions of partisanship. Even if you do make a mistake you will be forgiven; voluntary aiders are nice people, and they will not put you down as anything worse than a poor fellow whose education has been neglected.

II.—VOLUNTARY AID DETACHMENTS IN THE COUNTRY.

By Mrs. MARGARET HARKER.

County Director and Controller, Norfolk.

(1) A Voluntary Aid detachment must consist of at least sixteen members with both First Aid and Home Nursing certificates.

(2) Members must make at least twelve attendances during the year.

(3) Members must promise to help, should necessity arise—*mobile members* where sent, *immobile members* near their own homes.

(4) Members must attend the Annual War Office Inspection, unless special leave of absence is given by the commandant.

A detachment is raised in a country village by first finding a suitable commandant, and by helping her to organize courses of First Aid and Home Nursing lectures, with the understanding that the majority of those attending the lectures will join the detachment when formed.

In Norfolk there is a variety of work which members of women's detachments can undertake.

They help weekly at the Out-Patient Department and Bandaging Room of the Norfolk and Norwich Hospital, their travelling expenses being paid by the Norfolk Red Cross. Some detachments help the smaller cottage hospitals and the district nurses. Some run a child welfare centre. Some a medical supply depôt. Some have a regular working party making garments for the hospitals.

A detachment near an ambulance sends a member with the ambulance whenever there is a woman patient.

Those inspecting V.A.D. work in London, or other large towns, can, perhaps, hardly realize some of the difficulties in raising and maintaining a country detachment, especially since the war.

There are, in these days, few leisured members of detachments, so that, in many places, lectures and practices have to be held in the evenings. Distances in the country are long, and many cannot turn out after a day's work to bicycle or walk two or three miles for Red Cross meetings.

Village amusements have also increased, and there are many more counter-attractions in the evenings.

However, supposing that lectures have been held successfully, the examinations safely over and the requisite number have enrolled to form a Voluntary Aid Detachment—what difficulties still loom in front of the anxious commandant?

(1) *Money.*—How is money to be procured to buy the necessary uniform and equipment? No official grant is given; the members themselves cannot afford to give much. The commandant organizes concerts and whist drives, but a big effort has to be made before all are equipped.

(2) *Strength of Detachment.*—How is the detachment to be held

together? Lectures and practices must be frequently organized to keep the V.A.D.'s efficient and enable the requisite number of attendances to be made. In districts near a hospital, where V.A.D.'s are allowed to help, or where there is a Red Cross child welfare centre or Red Cross medical supply depôt, interest is easier to maintain; but when there is no practical work to be done ingenuity has to be used. Members (often the best) suddenly have to leave the district, and the distracted commandant has to hunt around to try and make up her numbers once more.

(3) *War Office Inspections.*—Then there hangs over the detachment the anxiety of that terrifying War Office inspection, at the thought of which many members threaten to resign! When, therefore, the annual inspection does take place, inspecting officers are begged to remember—

(*a*) The efforts that have been made to produce the requisite number of V.A.D.'s for their inspection.

(*b*) That probably only a small proportion of the detachment has ever seen the inside of a hospital.

(*c*) That nursing terms are difficult for village girls to master.

(*d*) That nearly all, however inefficient they appear, would do yeoman service, if the occasion should arise—as their predecessors did from 1914-18.

III.—A HOSPITAL UNIT AND CONVOY IN FRANCE.

By Miss ANN HOPE GAMWELL.

(*By kind permission of Miss M. B. H. Franklin, M.B.E., Commandant, F.A.N.Y.*)

The hospital of Lamarck in the Rue de la Rivière, Calais, was one of a hundred beds, and was run for the Belgian authorities by the First-Aid Nursing Yeomanry. It was housed in a convent school, the two three-storied buildings of which were in a somewhat dilapidated condition when taken over by the F.A.N.Y. on October 29, 1914. Patients had to be received before any of the equipment had arrived, and were accommodated on straw or palliasses. These first convoys consisted mainly of typhoid cases, a particularly virulent form of which was then raging in the Belgian army. Indeed, one whole building had to be devoted to typhoids for the first five months of the hospital's existence.

The English staff consisted of the O.C. or "Directrice," several sisters and the members of the corps, who acted as probationers in the wards or drivers for the corps motor ambulances. The Belgian staff included an adjutant, two doctors, and in later days a male orderly attached to each ward.

The corps was from the outset self-supporting, except for one or two supplementary Belgian rations, so that all monies collected in England for the work of the corps were devoted to the comfort and welfare of the patients. A frequent entry in typhoid diet sheets ran thus: "Eggs—two

by Miss and one by kitchen." The sisters, with two exceptions, were not Fanys, but were obtained and paid for by the corps.

It was pretty hard work arranging the equipment whilst nursing a full quota of men, and things were made no easier by the fact that the Fanys were obliged to move their own billets in the town every third day. There seems to have been some idea in the Calaisien mind that, if the English were allowed to settle, they would never leave after the war. Eventually, however, a permanent abode was obtained in the ground-floor of a shop—"Le Bon Génie"—at the far end of the town. This, when the windows had been pasted over with brown paper, provided room for beds which were always occupied; for, when the day staff stepped out, the night staff stepped in, and *vice versa*.

By this time the hospital was in full swing. Patients were received through the Hôpital de Passage at Calais Ville, and evacuated into ships which took them to Cherbourg. The Belgians were very short of all hospital material, buildings, nurses, equipment and orderlies, and were really grateful for the help afforded by the F.A.N.Y., and more especially for their nursing of the typhoid patients. These latter, previous to the arrival of the corps, had been nursed by nuns who, though charming and kind, had little or no idea of hygiene. The corps was now asked whether it could do anything for the convalescent typhoids. In consequence, a small convalescent home was opened at St. Inglevert near Calais. Two girls were on duty there: they fed and looked after their charges, took them for walks in crocodiles, and generally kept them out of mischief until they were strong enough to rejoin their regiments. That the Belgian soldier was really grateful is evidenced by the fact that these girls suffered from only one case of indiscipline during the Home's whole term of life.

Another offshoot of the hospital which came into being at about this time, was a regimental aid post behind the line in Flanders. To quote the officer of this detachment: "Within three miles of Dixmude, with rough fare consisting for the most part of coffee and black potatoes—sleeping on straw, having a cupful of water to wash in, treating wounded brought from the trenches by bearers—two or three of us had some unique experiences."

That "cupful of water to wash in" is the core of the situation; for the Fanys' favourite off-duty occupation was taking a bath. In Calais, to do this one went first to the Hôpital de Passage where one put in a request to the orderly officer for a "bon"; the request would often be met with—"But you have already had one bath this week, mademoiselle." Then one proceeded to the railway siding, where stood a luggage van containing four baths supplied with hot water from the boiler of a broken-down engine. Woe betide the one who undressed before ascertaining the heat of the bath; for there was no cold water, and one might call the orderly for long without being heard, as he was very deaf.

Zeppelin raids occurred at intervals, but little material damage was

done until one night in March, 1915, when a bomb hit the Cathedral which overlooked Lamarck yard. A probationer who was crossing the yard for her midnight meal was missed by inches by a coping stone which fell at her feet, and of course all the windows were broken. When the day staff arrived next morning the night staff was still engaged in trying to sort glass out of the men's beds. For days the hospital was a dismal place; for the windows had to be covered with blankets until such time as they could be reglazed—no easy matter in those days. It was, of course, bitterly cold.

At the end of April the falling off in typhoid cases enabled both buildings to be used for *blessés*, but their old building was known to the end as "typhoids." The English sisters found it difficult at times to accommodate themselves to Belgian ways—such a phrase as "Let sleep the sleeping men"—from a doctor always disconcerted them; but Sunday morning was their worst trial. The hospital chaplain held a service in one ward in each building regardless of what might be going on, and the procedure was as follows: The ward orderly and probationers arranged a suitable altar at one end of the ward; the probationer then went round the patients inquiring their religion, and the faces of those who were not Catholics were then covered with a newspaper. The priest then arrived and, assisted by the ward orderly, conducted his service, the doctor probably doing his dressings at the same time, and the non-Catholics breathing hard on their papers. For some reason or other it was considered etiquette for probationers to wash up in a devotional attitude, and preferably on their knees, after dressings were finished.

The hospital transport consisted of three ambulances and a motor kitchen. The former were hardly ever still. Apart from conveying patients to and from hospital, they had also to act as light lorries, and every bit of Belgian material of any sort whatsoever had to be fetched from Gravelines, fifteen kilometres north of Calais. Vehicles were very scarce (there were but seven other ambulances—six Belgian and one French—in Calais) so that the Lamarck cars were constantly borrowed by all and sundry. They, of course, helped the other seven cars to do the work of the hospitals, both Belgian and French; and later, the British too, until the arrival of a Red Cross convoy. They took the orderlies' training school gear to be disinfected—most unpleasant; they took doctors to La Panne—Mecca of all Belgian M.O.'s—where they might quite possibly be re-borrowed for inspection work farther on and might end up in the oddest places; they also, on one occasion, loaded a train, drove 120 miles, unloaded it, and returned next day. That was for the French. The real triumph, however, was reserved for the kitchen. This had been brought out with the idea of providing soup for the *blessés* on their arrival at Calais Ville and whilst waiting to be passed through the Hôpital de Passage; and very good work it did there. But at the beginning of May it went with two of our Corps who were attached to the regimental aid-post

of a Belgian battery proceeding to the Ypres Salient, and thus it saw that historic first gas attack of the war. The two girls tried to improvise gas masks from first field dressings for the bewildered Belgians and British who stumbled into the aid-post, and when they eventually returned to the fold at Lamarck they were themselves a sorry looking couple.

During the month of May the Lamarck transport was increased by an ambulance and a motor bath. The latter added not only to the cleanliness, but also to the gaiety of nations, and had the honour to bathe the sitting cases of the first convoy taken in by the Lahore British General.

The Belgian authorities had now formed a vast concentration camp near Tours, and asked the F.A.N.Y. to supply help in the tubercular and other wards. The first contingent was sent down from Lamarck, but subsequently Camp de Ruchard was run as a separate unit.

Lamarck was, up to the day of its closing, a chief centre of social life in the town. When pressure of work permitted, a large room on the top floor of the main building was turned into a common room, and there gathered, particularly on Sunday evenings, Belgians, French and later British. The hospital also found time to run a concert party which gave many performances in Y.M.C.A. huts before the advent of Miss Lena Ashwell.

At the end of 1916 the Belgians built a large hutted hospital in which they concentrated all their cases in Calais, and Lamarck consequently came to an end just two years from the date of its inception, the staff passing on to a hospital opened for the French at Prieuré de Binson, Epernay.

In the autumn of 1915 the suggestion that women might relieve more men by supplying the personnel for base ambulance convoys was first seriously considered; and in the event the Calais convoy was taken over by the F.A.N.Y. on January 1, 1916. The vehicles to be supplied with drivers were twelve ambulances, two fifteen-hundredweight lorries, one thirty-hundredweight lorry and one motor bicycle : a personnel of twenty-two was allowed—this to include O.C., cook, mess orderly and one male mechanic. The officers of the Corps were naturally anxious that the convoy, which was in the nature of an experiment, should be open to as little criticism as possible; consequently the first draft contained as many old hands from Lamarck as could be spared. In spite of many months' experience, most of these troops had "the wind up" badly on that cold January morning, when they exchanged the comparative security of their billet at Lamarck for the bleak hilltop on which were perched the tents which constituted their new abode. "Driving for the English" was a terrible responsibility.

The F.A.N.Y. took over in time to carry out the 9 a.m. evacuation; therefore as soon as the cars could be got going they left camp; the last that was seen of the "relieved" men being Major Paget of the B.R.C.S. doing "Eena, meena, meina, mo," to select the one to be left behind with us. This poor lad dissolved into tears.

The E.M.O. was the officer from whom Miss Franklin—hereinafter called the "Boss"—obtained her orders; but they were not easy to come by, for there was no telephone in the camp and everything had to come up by orderly from the Lahore British General. In the daytime this worked fairly well; but on a windy night, with the sand blowing in his eyes, the man's well meaning effort to wake but one tent usually resulted in a pitch over tent ropes, accompanied by loud groans. Tent pegs were a great trial in the loose sand, more particularly those of the old store tent used as a mess. There seemed always to be half a gale blowing on that hilltop: it was an almost daily occurrence to see the cookhouse staff chasing the breakfast bacon round the tents on their way to the mess. The really sensible people were those who dug themselves into some old bathing huts standing round the camp. They made most admirable bedrooms, and one was employed as a workshop. For the first few months the F.A.N.Y. rationed themselves, but later they were given Army rations, drawn at first through the Lahore British General, and afterwards direct from the D.I.S.

The work at first consisted mainly of unloading trains, and evacuating the hospitals into hospital ships, for there were few local troops; but by degrees the work increased and barges came into existence. These latter came down the St. Omer canal and were used only for very bad cases. Unloading them was a real strain on the drivers.

The boss invariably accompanied the cars on any convoy job, assisting the E.M.O. to calculate the number of cars required and issuing the necessary orders to the drivers. Her laconic "Come back" could be very distressing hearing. The most difficult, and therefore the most entertaining, evolution performed by the convoy was the evacuation of hospitals to ships. The difficulty lay in that the Calais quay was infested with bollards, iron railings, electric cranes, coal trucks lying off the minesweepers, etc., and was, in addition, wide enough to admit of turning a car in one spot only. All was well when one could get the use of the quay itself; but when one was restricted to the platform, a fraction of an inch either way meant a nasty drop, and the only means of egress was across the main line rails and down the frequently crowded station platform. On one occasion, after depositing her patients, a new hand made a fractional miscalculation, and paid for her error with a nose dive of about thirty feet into the harbour. Car and driver were recovered in good condition.

In April the convoy moved into huts which had been built for them, containing cubicles, a telephone and two bathrooms; the marquee being retained as mess hut. This was a marvellous advance for, with the clearing away of the tents, a garden could be planted and the camp made ship-shape with whitewashed ropes and stones. The numbers of the convoy increased, as did the need for ambulances, and there were now, besides the boss and a section leader, one serjeant, one corporal and two lance-corporals. All members were on duty until 5 p.m., taking turns on an alphabetical roster for local calls, and all turning out for trains, barges

and evacuations. From 5 to 9 p.m. two members did local calls, and from 9 p.m. to 8 a.m. a special night roster was in force. This arrangement, of course, was the ideal. In practice it was seldom that the convoy got off before 6.30 or 7 p.m., and frequently not till 11 or 12. On any of the seventy nights on which Calais received air raids, they only retired intermittently. The two fifteen-hundredweight lorries were employed in supplying the needs of the hospitals, but this work was later done by horse transport and the lorries withdrawn. The thirty-hundredweight lorry carted stretchers and blankets and rationed trains and barges.

The convoy prided itself on its punctuality, and everything humanly possible was done to ensure calls being answered promptly. In the severe frosts a night guard was maintained whose duty it was to wind up all the cars every half hour throughout the night, so that they might be ready for immediate use. Even then, some of them would freeze up between "winds" and have to be thawed out and towed to get started. On one of these occasions a sleepy night guard forgot that a towed car requires a driver, and did not remember until her tow took the section leader's cubicle head on.

A big camp sprang up at Audruicq, fifteen kilometres from Calais, and two cars were stationed there, the drivers being relieved monthly. These latter were able to be of real assistance on the night in July, 1916 when the ammunition dump went up, shaking all Calais. One girl got the boiler fire to work, while the other helped the S.M.O. and orderlies. The whole convoy was ordered out, and arrived to find dumps of shells going off in all directions. Another really bad night was that on which the Bosche made a mistake and bombed the German prisoners at work in the quarries twenty kilometres from Calais. Terrible damage was done and the convoy had its hands full. Normally, cars carrying prisoners of war were provided with armed guards; but on one occasion, when these gave out, a driver, carrying three influenza Bosche and a delirious Britisher, heard a fearful scrapping in the back. Struggling for a few words of German, she at length achieved "Nicht spücken und nicht hinauslehnen." Immediate silence reigned.

Another "outpost" was that at the aerodrome at Marquise, where two cars and three drivers were kept, the third driver helping in the small hospital. On one occasion the three Fanys stationed there received the M.M. for their services. These outposts were never very popular, as it meant being away from the convoy for a month. Two other jobs besides outposts were unpopular; retrieving drowned men from the canals—often a very ticklish job—and taking lunatics to Boulogne. This latter was unpleasant for the reason that, if one had a puncture and was obliged to stop, the patients were all too apt to discard their clothing in the road. On one occasion also a driver only just escaped being throttled.

"Accident from the ordnance to the civil hospital." This sounds a simple enough job, but in reality it called for tact and ingenuity. The civil

hospital, so far as members of the convoy were able to discover, was run entirely by an elderly charwoman, and she was not often there. On arrival with a case, one had first to search the wards for a suitable bed, then to prepare it, and get a hot-water bottle, and then to go out into the highway, and enlist stretcher-bearers. After one experience one learnt to dismiss the stretcher-bearers before putting the case to bed, as this was the signal for the other patients to rise and help; and since they were clad elegantly, but inadequately, in a night cap, it was better to have the place to oneself. It was a miserable business, for if the case were at all bad it stood little chance of recovery.

Life in the camp could never be called dull. Apart from the fun indigenous in a mess of about forty high-spirited individuals, something amusing was always turning up. One driver fell into the canal and was rescued by "Chinks"; a new hand turned her car, and incidentally the boss, over and over down an embankment; and one night the Bosche engineered a joke. They dropped six aerial torpedoes in a circle round the camp, but next morning only five holes were to be found. Search as the Fanys would. they could not find the sixth, until the lorry driver noticed a little displaced sand by her front wheel. The British authorities, duly informed, sent up an inspector; but he unkindly inquired whether the convoy had ever heard of rats. However, next morning a French serjeant, three men, and two large crowbars retrieved from that small hole a seven-foot aerial torpedo, whose nose was eleven feet from the surface. This was, of course, a treasured souvenir in the mess for the rest of the war. In the autumn of 1917, a dug-out was built for the Fanys where, with a telephone, a gramophone, and a cigarette, one could be quite comfortable until it was one's turn to go out. Up till then it had been a bit depressing waiting about in the dark.

When work was slack a system of "half days off" was instituted, and on these occasions one did what one liked, consonantly with the Rules of the Geneva Convention and the dignity of one's uniform. Everyone had to be in camp by 10 p.m. unless on duty, or with special permission. Riding was a favourite "off-day" pursuit with the Fanys, and great was the pleasure given by the many officers who lent them horses. The F.A.N.Y laid down no rules of conduct for its members: this matter was left to their own good sense to adjust as circumstances arose. Internally, however, there were innumerable byelaws, written and unwritten, infringement of any one of which swiftly earned fatigues.

On one occasion the stretcher-bearer party was reduced from sickness and other causes to two men; whereupon, there being no other help available, the Fanys themselves unloaded a hospital train into a ship, 300 stretchers in two hours being their contribution to this branch of industry.

It is impossible to instance all the outstanding incidents of the convoy's life. There was the night of the second Audruicq explosion, when the convoy had difficulty in getting out of Calais owing to débris in the streets;

the night of the bombardment from the sea, when the shells whizzed over the camp—some of them so low as to make the gravel on the parking-ground fly round—and many others. On each and every one the cars were out either as a convoy or in ones and twos, and it remains a miracle that none of them was ever injured. There was but one accident, when a lorry was knocked over by a train, the unfortunate driver losing her leg.

On May 6, 1919, the Calais convoy was relieved by the R.A.M.C. convoy; and the former returned to England, bringing most of its ambulances with it in the Channel ferry. Thus the convoy's last drive together was from Richborough to London.

IV.—A TOWN VOLUNTARY AID DETACHMENT.

By Miss KATHERINE ACLAND.

Acting County Controller, Hertfordshire.

Formation.—The St. Albans detachment was originally formed in 1911, by the two Vice-Presidents of the St. Albans Division of the Hertfordshire Branch of the British Red Cross Society, the late Countess of Verulam, and Lady Thomson, together with Mrs. A. N. Boycott, under the auspices of the Territorial Force Association.

A committee was formed, and the Secretary and Assistant County Director of the Herts B.R.C.S. came from Headquarters to explain the work of a voluntary detachment with the result that Mrs. Boycott, herself a trained nurse, was appointed commandant, and Dr. S. Clarke, M.O., with Miss Irene Phillips as the first quartermaster.

Lectures in First Aid and Home Nursing were given according to the St. John Ambulance Association syllabus, and the first War Office inspection was made on May 31, 1913, the late Colonel S. C. Robinson, C.B., County Director, being present.

The first inspection was held at Townsend House, the stables being used to provide a temporary ward.

The following year the detachment made more ambitious efforts. The inspection was held in the Drill Hall, where the detachment proceeded to provide a quartermaster's store, and from that equipped wards, dressing station, kitchen, etc. The Gas Company lent gas-stoves for the occasion, and the cooking demonstration proved a draw for the whole neighbourhood.

Colonel Poynder, R.A.M.C., expressed his entire satisfaction with the work of the detachment as exhibited in this demonstration.

Training.—Members of the detachment besides attending lectures and rehearsals worked at the St. Albans and Mid-Herts Hospital, and so gained practical experience.

Personnel.—The detachment was extremely fortunate in its original commandant, Mrs. Boycott, a very highly qualified trained nurse, to whose sense of discipline and organizing ability much of its success is due. She

always had the highest ideals for the detachment, and during the war the hospital which was under her charge was run on lines which would well compare with one staffed by regular trained nurses.

She was much helped by Lady Thomson, the Vice-President, who gave invaluable help as Assistant-Commandant during the whole period of the war. Following Miss Phillips, Miss Wix did splendid work as quarter-master and Miss Silvia Glassop's cooking will never be forgotten! In fact, she gained such a reputation that the C.O. used to send his men from the field ambulance to her for instruction. She or her deputy attended the hospital daily with at least two members of the detachment working under them, and four other helpers washing up.

The present Countess of Verulam worked enthusiastically as a nurse, and her example was of the greatest value.

It is impossible to make any particular mention of the original members, but when the detachment was mobilized in December, 1914, it was found that there were sufficient nurses to do the duty required of them in addition to those who served at home and abroad in military hospitals and the supply never failed until the hospital closed on January 31, 1919.

It is curious to compare the rather frivolous attitude adopted by the authorities before the outbreak of war with the help and encouragement which is afforded to V.A.D.'s at present after the serious work adequately performed by them has been recognized. One Territorial colonel announced "that he was not going to have any of *his* men messed about by a lot of girls trying experiments." Another asked for "a few girls and a few flowers to brighten the wards before an official inspection."

Equipment.—Under the original 1911 scheme the Abbey Institute, St. Albans, had been fixed on as a temporary hospital, but this building was requisitioned by the War Office on the outbreak of war. Bricket House was, therefore, secured in the first week of August, 1914, and prepared at a few hours' notice at the request of the military authorities as a hospital suitable for receiving forty patients, the detachment holding itself in readiness for immediate service.

An elaborate scheme of "promise" had been made in 1911, and these were all called up and the hospital fully equipped. Lady Verulam and Lady Thomson opened a fund for providing extra comforts for the patients which met with generous response.

Activities.

(*a*) *War Time.*—Bricket House was temporarily occupied by the 6th Field Ambulance when stationed in St. Albans district in September, 1914. The detachment was mobilized on December 9, 1914, and the hospital opened in full working order and remained in commission until January 31, 1919.

During this period 2,298 in-patients were treated, 336 operations (mostly

major operations) were performed and 2,168 out-patients received attention. In addition, massage was provided for disabled men. The hospital was used for troops (both officers and other ranks) stationed in the district, and was at no time used as a convalescent auxiliary hospital.

The first serious cases to receive attention were the victims of an aeroplane crash in 1915—both the pilot and observer being seriously injured—the observer remaining in Bricket House Military Hospital three months.

The first air raid over St. Albans caused great consternation as an emergency appendix operation was in progress when all the lights were suddenly cut off, and the operation had to be completed by hastily lighted candles. The patient did well and was proud of his recovery.

Cases of every description were treated, with the exception of infectious cases.

The staff of the hospital consisted of the commandant, assistant commandant, two or more trained sisters as required, with the members of the detachment working on day shifts from 7 a.m. to 1.30 p.m., and 1 p.m. to 8 p.m., and night shifts from 8 p.m. to 8 a.m. The quartermaster was in charge of stores and linen, and the commandant's secretary undertook the clerical work. The commandant organized a sewing room where many willing helpers unable to nurse gave their services in mending hospital linen and attending to soldiers' kits. One member had this department under her special charge.

The trained sisters were engaged by the commandant; at one time Canadian sisters took duty at Bricket House.

R.A.M.C. officers stationed in the district attended the hospital for the whole period, with the exception of three months in 1915, when all medical units had been sent overseas.

Their duties were voluntarily undertaken by local medical practitioners. Orderlies for duty were supplied by the R.A.M.C.

The hospital did its full share of work during the great influenza epidemic of 1918-19, and it was finally closed on January 31, 1919.

The massage and electrical treatment for discharged and disabled soldiers was continued after the hospital was closed.

The finances of the hospital were most admirably administered by the Treasurer, Dr. A. N. Boycott, who on its closing handed over £777 to the Herts Demobilization Committee. Over £12,000 passed through the hospital account.

(*b*) *Peace Work.*—The detachment was kept together after the war. Courses of First Aid and Home Nursing lectures are given annually. Notices of these are always sent to the local press, and this publicity helps recruiting.

Members work at the civil hospital and at the massage clinic, and on various occasions such as big public gatherings.

In November, 1924, V.A.D. Herts, Thirty-Eight, was re-registered under

the new scheme. In 1927, Mrs. Boycott became Hon. Commandant, and Miss Peake an original member, who had served in military hospitals during the whole of the war, took over the active work of running the detachment.

Mrs. Dunham is the new Lady Superintendant and Dr. Kenneth Bates, Medical Officer.

The first War Office inspection was made on October 30, 1926, when the County Controller, Brigadier-General R. H. Hare, C.B., C.M.G., was present. The detachment was again inspected on October 29, 1927, by Colonel Rutherford, D.S.O., A.D.M.S., E.A.A., and Major Phillips, D.S.O., M.C., R.A.M.C., when Miss Acland was present as Acting County Controller in the absence of General Hare.

Lectures are given each month, and all necessary equipment for inspections is borrowed as required, as the hospital stores were given away when the hospital was closed.

A team from the detachment won the Hertfordshire Inter-Detachment Round of the Stanley Shield Competition in the spring of 1927, and was only defeated in the eastern area competition by one mark, by Essex.

The detachment is at present well up to strength under its excellent Commandant, Miss Gertrude Peake, and is fortunate in having in its ranks a fully qualified London hospital nurse as well as its own lady superintendant.

Miss Wix (sometime Lady Mayor of St. Albans) still acts as quartermaster, with Miss Green as A.Q.M., and there are at the present time nine mobile members (four of whom have done their week's training at a military hospital, whose reports have been universally satisfactory) and thirty-three immobile members, including the commandant's secretary, one dispenser and three cooks.

The keenness and efficiency of the detachment, and its ability to attract more recruits, are most hopeful signs of the progress of the new scheme for V.A.D. work in the county of Hertfordshire.

V.—INSPECTING A VOLUNTARY AID DETACHMENT.

By Major M. B. H. RITCHIE, D.S.O.

Royal Army Medical Corps.

In a charming village nestling in the valley ten miles from nowhere, bustling market town, popular seaside resort, or one of England's stately homes that still harbours butlers bland of visage and footmen fleet of foot—somewhere within the broad shires of the A.D.M.S.'s area, a voluntary aid detachment awaits your inspection. You, let me say, have been reversing round the market square among the sheep pens trying to find the map reference until the school children came to put you wise. In hut or hall dedicated to every form of uplifting institution for which rural England is

renowned; or in the Territorial headquarters, shoulder to shoulder with eighteen-pounder and landscape target; or upon a smoothen lawn—two score of damsels in the trim uniform of the British Red Cross Society or the Order of St. John of Jerusalem are drawn up for review, all agog to display their knowledge of first aid.

The gracious commandant receives you. You shake hands with her and her officers. Probably the county director and the county controller are there to support you, but they are more interested, of course, in matters of uniformity of uniform. Skirts so many (not too many) inches off the ground; apron bands right over left; invisible pins. You walk along two ranks of be-medalled and charming personnel. Among them you may find some friends. Certainly some one has a near or far relation in the Corps, or knows some one that you know. The ice breaks.

I think most inspecting officers prefer to set their own tasks and test efficiency by their own standards. If left to itself, however, the detachment will pre-suppose a catastrophe sufficient to satisfy the most inveterate first-aider. A motor 'bus has overturned. Out of it come Boy Scouts or Girl Guides in order of severity—fractures, fibula or femur, carpus or clavicle; burns, to the umpteenth degree (the old 'bus blew up before she took the water); drowning "fares" demanding the immediate attention of friends Schafer, Sylvester and Howard, as *per* manual; and a rearguard of tenderfoot scouts labelled collectively as shock. Gruesome grist comes readily to the merciful mill of first aid.

The detachment bustles. Splints and bandages soon conceal the persons of the victims. You walk around and see how it is done. One patient, already an acute pneumonia, has been thrust into bed. So you ply attendants with question after question on home nursing. The work of nursing in a hospital may be of more importance than first aid, but this depends upon your personal ideas of the duties of voluntary aid detachments in the next great war. So you can find ample scope. Then the quartermaster's department has to be inspected. The commandant is *au fait* with the Geneva Convention and Army medical administration. You should probe her profound knowledge of these important matters. But do it tenderly. The cooks have prepared inviting invalid diets. Be careful to praise the culinary effort loudly; for the cooks may be *real* and you know how precious they are.

The personnel sometimes suffer from shyness. A trifle slow off the mark with their answers, but recovering from bashfulness rapidly. You find that they know quite a lot about the uses of bandage, triangular, and "splint, wood, arm, right or left, bacon boxes from." Question and answer have taken longer than expected, time has passed rapidly but pleasantly. The personnel is personable.

So you draw near to the close of your inspection. You are shown a maze of figures and forms (paper), and presented with no fewer than five copies of an inspection report. You beg to be excused, having inadvertently

left your clerk, Class III, behind, compiling third reminders in red ink on the touch-line of the football ground. What a lovely Saturday afternoon he has missed—rendition in umtuplicate, *proformæ in excelsis!* You can tell him all about it on Monday morning, after you sign the nineteenth copy of the morning states. Meanwhile the detachment has fallen in and you ask why. "Oh," you are told sweetly, "we are waiting for your speech."

Something has to be said, and you have something prepared. A gentle touch of high falutin' and a good strong dash of encouragement, perhaps a chide at some glaring example of ignorance, innocent and undismayed. If you are given to expressing approbation, and the detachment deserves it, lay it on good and hearty. These individuals are giving up their time to duty undertaken for the good of the country and community; they are working unselfishly and deserve every encouragement. *Apropos* of speeches, how well many of our senior officers speak in public! I have heard the best orations at Red Cross Rallies delivered by them. Cheers for the Colonels—late R.A.M.C., and removed from the Corps! Bravo! the brevets!

The last impassioned words of your oratory die down and the inspection ends. Then may come tea, and perhaps question and answer, but not on first aid. Finally, you bid farewell. A pleasant afternoon, you think, and nice people. Perhaps you hope you may meet some of them before the next inspection.

And so to the starting handle.

FURTHER RESULTS IN MOSQUITO PROOFING BARRACKS.

By Lieutenant-Colonel J. B. HANAFIN, C.I.E.,

Indian Medical Service.

The following notes are written in continuation of the article by Major Campbell Munro, I.M.S., published in the Journal of the Royal Army Medical Corps, October, 1927. They bring the situation up to date.

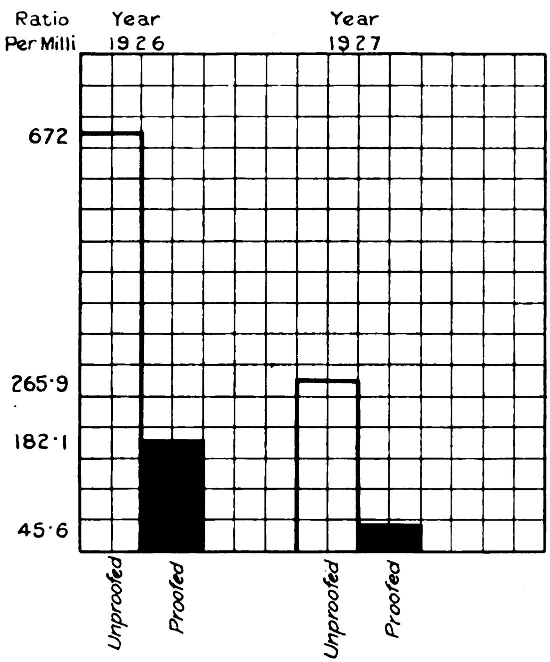


Chart to illustrate the malaria admissions from proofed and unproofed barracks, Lahore Cantonment.

Napier Lines Barracks, which accommodate the British Infantry in Lahore Cantonments (formerly called Mianmir) were completely mosquito-proofed in July, 1926. The remaining British barracks, which are unproofed, adjoin Napier Lines Barracks.

In former years there was no difference in the admission rates between these barracks. Both were equally malarious.

The following table shows the marked diminution in admissions for malaria among the troops now occupying the proofed barracks, compared with the troops occupying unproofed barracks in the same station for the years 1926 to 1927.

The malarial months—August, September and October—are taken.

The table also shows the diminution in admissions for malaria for the proofed barracks in 1926 and 1927, compared with the same barracks unproofed in former years.

TABLE I. COMPARISON BETWEEN PROOFED AND UNPROOFED BARRACKS IN LAHORE CANTONMENT, AUGUST 1 TO OCTOBER 31.

	British Infantry				Other British Units			
Year	Average strength		Malaria admissions	Ratio per 1,000	Average strength		Malaria admissions	Ratio per 1,000
1923	588	Unproofed	500	850·34	352	Unproofed	190	539·77
1924	489	,,	236	482·62	309	,,	95	307·44
1925	281	,,	190	569·40	334	,,	157	470·06
1926	302	Proofed	55	182·12	293	,,	197	672·35
1927	285	,,	13	45·61	391	,,	104	265·98

To obviate possibilities of errors due to "optimistic" diagnosis, Table II, showing admission rates for all indefinite fevers, viz., dengue, sandfly, influenza and fevers of unknown origin, is appended for the same troops for the same period. These fevers show no increase. No other disease could, intentionally or unintentionally, be mistaken for malaria.

TABLE II.—INCIDENCE OF DENGUE, SANDFLY, INFLUENZA AND FEVERS OF UNCERTAIN ORIGIN COMPARED WITH MALARIA IN PROOFED AND UNPROOFED BARRACKS IN LAHORE CANTONMENT, AUGUST 1 TO OCTOBER 31 (EACH YEAR).

Year	British Infantry					Other British Units				
	Average strength	Malaria		Dengue, sandfly, influenza and fevers of uncertain origin		Average strength	Malaria		Dengue, sandfly, influenza and fevers of uncertain origin	
		Admissions	Ratio per 1,000	Admissions	Ratio per 1,000		Admissions	Ratio per 1,000	Admissions	Ratio per 1,000
1923	588 unproofed	500	850·34	*Nil*	*Nil*	352 unproofed	190	539·77	*Nil*	*Nil*
1924	489 ,,	236	482·62	4	8·18	309 ,,	95	307·44	4	8·18
1925	281 ,,	160	569·40	17	60·67	334 ,,	157	470·06	6	21·35
1926	302 proofed	55	182·12	*Nil*	*Nil*	293 ,,	197	672·35	1	3·31
1927	285 ,,	13	45·61	2	7 01	391 ,,	104	265·98	4	14·03

The British barracks at Amritsar, which is situated thirty-five miles from Lahore Cantonment, were proofed in December, 1925. Amritsar, like Lahore Cantonment, has always suffered severely from malaria.

As all British barracks at Amritsar have been proofed comparison with unproofed barracks for the year 1926 and 1927 cannot be made.

The number of troops stationed at Amritsar is small. Marked diminution in the malarial admission rate for the years 1926-27 is however shown.

The year 1927 has been a year of low malarial infection generally in the Punjab, but the diminution in the admission rate in no way approaches the diminution as shown in the troops occupying proofed barracks in Amritsar in 1927.

TABLE III.—BRITISH INFANTRY COMPANY, AMRITSAR CANTONMENT, AUGUST 1 TO OCTOBER 31.

Year		Average strength	Malaria admissions	Ratio per 1,000
1923	Unproofed	166	118	710·8
1924	,,	194	145	747·4
1925	,,	199	122	613·0
1926	Proofed	146	25	171·2
1927	,,	137	8	58·4

The other usual anti-malarial measures were carried out at Lahore and Amritsar Cantonments during the years quoted on the tables.

In addition, barrack rooms were periodically fumigated with cresol vapours (four ounces of saponified cresol to 1,000 cubic feet).

The mosquito proofing has been well carried out. Non-corroding brass wire net has been used, apertures 16 × 16 to the square inch.

All doors are doubled and are automatically shut by springs. Rents in the wiring are immediately repaired by personnel of the unit detailed for the purpose.

The incidence of malaria in Lahore was comparatively low for the year 1927.

Tables showing incidence of malaria among Indian troops at Lahore, for years 1923 to 1927, inclusive, are appended. Indian barracks are not proofed.

TABLE IV.—INDIAN TROOPS, LAHORE CANTONMENT.

Year	Average strength	Malaria admissions	Ratio per 1,000
1923	2,203	875	397·2
1924	2,293	883	385·1
1925	2,553	913	357·6
1926	2,434	883	362·8
1927	2,339	441	188·5

Although the improvement shown in the protected British troops is partially accounted for by the less malarious year 1927, the comparative tables for proofed and unproofed British troops occupying neighbouring barracks at Lahore show convincingly the merits of mosquito wire-proofing of barracks.

The striking results obtained by mosquito proofing houses, as exemplified by these statistics which cover a period of two years, raise the question whether the proofing of buildings should not be the chief anti-malarial measures for European residents in tropical countries. There is no doubt it is most suitable for organized bodies, such as troops in barracks.

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The complete or partial elimination of the anopheles carrier by extensive anti-larval measures is a better ideal, and in situations where it is found practicable should undoubtedly be undertaken. The mosquito possibly occupied the tropics before man. It is a constant and often an unsuccessful fight to eliminate him from his natural grounds, and any relaxation of these expensive measures means failure.

The domestic habits of the infected anopheles have been pointed out by Colonel James.

When the advantages of properly screened houses are more generally known, and the expense involved is reduced by a greater demand for and production of a durable wire screen, it will be considered as reasonable to protect buildings from mosquitoes in the tropics as it is to protect houses from the cold in the Arctic.

The advantages of proofing, besides the protection it affords against malaria, are: (1) Freedom from the constant annoyance and irritation of biting insects—life in the tropics is made bearable; (2) freedom from the inconvenience of mosquito nets; (3) the breeze from the fans and punkhas has uninterrupted access to the body.

Disadvantages: (1) Original and upkeep cost limits its application; (2) interference with ventilation—this is so slight as to be neglected.

Proper screening of our houses in the tropics has placed at our disposal a means, too little used in India at any rate, of avoiding malaria and making life more pleasant.

Editorial.

REPORT OF THE LISTER INSTITUTE OF PREVENTIVE MEDICINE.

THIS report was issued in May, and gives a brief review of the research work carried out in 1927.

In view of our previous editorials, the experiments on nutrition are of particular interest. In the June editorial we referred to the work of Dr. Harriette Chick and Miss Roscoe on the constituents of water-soluble B vitamin. In the present report it is suggested that these should be called provisionally vitamin B_1, the anti-neuritic and more heat-labile constituent, and vitamin B_2, the so-called anti-pellagra more heat-stable constituent.

Dr. Chick and Miss Roscoe find that when young rats receive a diet complete in all other respects, but devoid of vitamin B_1, they survive only three to four weeks and die with or without symptoms of paralysis. If the diet is deficient only in vitamin B_2, life may be prolonged for two to three months longer, but there is no increase in weight, and growth is at once restored if vitamin B_2 is given. The uncertain occurrence of skin lesions, dermatitis, and loss of fur, which are characteristic of vitamin B_2 deficiency and considered by Goldberger and his colleagues to be the analogue of human pellagra, has been found to be due to variations in the basal diet caused by incomplete purification of the caseinogen used as the source of protein. When caseinogen has been elaborately purified, the skin lesions develop consistently on a diet deficient only in vitamin B_2. Caseinogen and other substances of a protein-like nature appear to absorb vitamin B_2, and the high nutritional value of casein as a protein may be due not only to the nature of its amino-acid constituents, but also to the fact that it may contain vitamin B_2 as a contamination. It is thought that this circumstance may explain why Goldberger obtained disappointing results in the prevention of human pellagra when large daily doses of purified casein were tried, while milk, skim milk, or butter milk proved of great value. Conclusions regarding the biological value of casein and other proteins will clearly need revision.

Both vitamins B_1 and B_2 are present in yeast. By the method of Peters and Kinnersley a concentrated preparation of B_1 can be prepared which is devoid of vitamin B_2. Attempts are now being made to isolate B_2 and study it apart from B_1.

"Refection," the spontaneous occurrence of the capacity to thrive on diets deprived of B vitamins, recently studied by Fridericia, in Copenhagen, was also discovered independently at the Institute. The most probable

explanation, and the one adopted by Fridericia, is that the alimentary tract of the animal becomes infected with some yeast or other organism, and thus the materials are produced which are needed to correct the different defective diets.

Dr. Smedley-Maclean has found that yeast fat contains another unsaturated sterol, besides ergosterol, which she has named zymosterol. Miss Hume and Miss Smith are endeavouring to ascertain whether this sterol can be activated by ultra-violet light.

Like ergosterol, zymosterol is highly unsaturated, containing three ethylenic linkages, and is precipitated by digitonin. The separation of the two sterols is therefore not easy. Zymosterol is distinguished from ergosterol by its greater solubility in organic solvents, its dextro-rotation, and the absence of selective absorption in the ultra-violet region.

It has not yet been possible to prepare zymosterol in an absolutely pure condition, but it is known that on irradiation it does not produce, weight for weight, as much vitamin D as ergosterol. It is possible that such activity as zymosterol possesses after irradiation may be due to the impurity of ergosterol in it.

We referred in the June editorial to the action of ultra-violet light on the skin; the supposed extreme opacity of the epidermis to ultra-violet light has made it difficult to understand how sufficient energy of the requisite wave-length could penetrate as far as the capillaries. Dr. Lucas has been re-investigating the opacity of the epidermis to ultra-violet light of different wave-lengths, and his experiments indicate that the opacity has been exaggerated, and that a considerable amount of ultra-violet light, even up to wave-length 240 $\mu\mu$, penetrates the epidermis of the skin of the arm. The lack of optical homogeneity of the epidermis, and the consequent scattering of the pencil of light, a fact not taken into account in previous experiments, has so far prevented him from arriving at a numerical value for the opacity of the epidermis.

In his chemical investigations on the antiscorbutic factor in lemon juice, Dr. Zilva has studied the process of inactivation of the active principle. Having found that phenolindophenol is reduced by antiscorbutic fractions, he investigated the relation of the reducing capacity to the antiscorbutic activity. It appears that the reducing agency and the antiscorbutic factor are not identical, but the former contributes to the stability of the latter. By the removal of impurities the antiscorbutic factor becomes very unstable and a stage may be reached in the purification when the activity will not be detected by the ordinary biological method.

Work on the relative antirachitic and vitamin A properties of butter obtained from cows fed on various diets has been continued by Dr. Zilva and Miss Soames. The daily addition of two ounces of cod-liver oil to a winter ration did not significantly raise the vitamin D of the butter; higher doses did so, but were accompanied by a concomitant depression in the milk fat.

Dr. T. Lumsden has continued his investigations into the feasibility of producing a vaccine effective against malignant tumours. Antisera can be produced which kill cancer cells *in vitro* invariably and specifically, but when injected into a growing tumour these antisera are so rapidly absorbed into the general circulation that they become ineffective. Dr. Lumsden and Dr. Stephens have found that by combining the use of antiserum with adrenalin, about fifty per cent of rat sarcoma can be caused to disappear, and the rats so cured are immune to the subsequent implantation of sarcoma and of rat cancer. In the case of rapidly fatal implantable tumours, Dr. Lumsden considered it was necessary to find some means of delaying the growth and of so injuring some of the cells as to produce a vaccine in the body capable of evoking an active immunity which would complete the cure. By injecting one per cent of formalin into growing tumours he has found that over ninety per cent of them disappeared, and the animals so cured were highly resistant to the subsequent implantation of the tumour concerned. The applicability of the treatment to spontaneous tumours in man is now being tested, but the great difficulty is to obtain suitable cases.

Professor Ledingham has elaborated a method of propagating vaccine virus in the dermis of the rabbit. The virus is inoculated intradermally. Subsequently the site of the reaction is excised, the material ground up with phosphate solution and again passed through susceptible animals. The potency of this passed material reaches a high level, but seems to be accompanied by diminution of response when placed on the scarified skin.

In recent months Professor Ledingham has endeavoured to pass small-pox material from the prevailing small-pox in England, from rabbit to rabbit, but with only moderate success. The passed material from the dermis seems to lose its virulence rapidly. As a laboratory test for small-pox the intradermal inoculation of the rabbit with human material is recommended.

Dr. Arkwright has continued his studies on the antigenic structure of bacteria. He has shown that the connexion between the heat-labile antigen and the flagella of *Bacillus typhosus* can be demonstrated under the microscope. When acted on by an antiserum which agglutinates the H antigen, the living motile bacilli immediately cease to move and become grouped in large, loose clumps formed of agglutinated flagella ; whereas in the presence of antiserum for the O antigen the bacilli adhere by their bodies, the flagella remaining unagglutinated, and the clumps are carried about by the active movements of the flagella.

Dr. Fairbrother, in a research on cholera prophylaxis, has shown that the antigen contained in the supernatant fluid of centrifuged young cultures of *Vibrio choleræ* possesses little or no protective value for guinea-pigs injected therewith. It appears that such fluids contain only flagellar or heat-labile antigen, which is incapable of inducing the development of protective antibodies, as Arkwright has shown in the case of *B. paratyphosus* A.

Only the heat-stable antigen of an organism appears capable of inducing protection against a lethal dose of the microbes.

Dr. Eagles has completed a research on streptococci and scarlet fever. He finds that virulence, or lack of virulence, is not invariably associated with a particular type of colony. In some strains the rough colony is the less virulent; in others, notably in the Aronson strain, which is very virulent for mice, the non-virulent form is associated with the smooth type of colony. It is considered that the investigation of these variations is of fundamental importance for the systematic study of streptococci in relation to disease in men and animals.

In view of the claim that *B. welchii* plays some part in the ætiology of pernicious anæmia, Dr. Orr and Dr. Campbell have carried out a large series of experiments in which emulsions of red cells were exposed to the action of filtered broth cultures of *B. welchii*. In the presence of the toxins of this bacillus, it was found that the red cells passed through definite changes; microcytes appeared first, then macrocytes; these were followed by a stage when the majority of the remaining cells resumed their normal diameters. This change in size was not met with when the toxins from *V. septique*, *B. tetani*, streptococci, or staphylococci were used. When blood was reduced the changes occurred more rapidly than in oxygenated blood.

Formalized antigens have been used for nearly a year for the production of antitoxic sera. These relatively atoxic antigens are less liable to cause severe reactions in horses, though occasionally quite considerable reactions are seen. Unmodified tetanus toxin is not free from risk of producing local or general tetanus, but the formalized toxin appears to make the immunizing process a perfectly safe one, and gives excellent results in a comparatively short time. The results obtained in the preparation of diphtheria antitoxin have been equally satisfactory. Formalized dysentery and plague toxins have also acted as efficient antigens.

It is stated that Dr. Green's chloroform method of destroying the extraneous micro-organisms of vaccine lymph has been applied to lymphs issued since the beginning of July, 1927. It has been found that the extraneous micro-organisms contained in the raw lymph can be almost entirely eliminated in an hour or so, while, by repeated passages of air through the treated emulsion for twenty-four hours, all traces of chloroform are removed. No difference in virulence of the chloroformed and the unchloroformed portions of the same virus have been observed, and high case and insertion success results have been reported.

Clinical and other Notes.

EARLY TREATMENT OF MALARIA.

By Captain A. P. DRAPER, M.C.,
Royal Army Medical Corps.
Senior Medical Officer Transjordan Frontier Force.

The following notes on malaria in the Transjordan Frontier Force may be of interest :—

From April 15 to July 31, the whole or part of the Transjordan Frontier Force was engaged, in conjunction with the Royal Air Force, in active operations against the Druzes at Azrak in the Arabian Desert. This Azrak is a large oasis with very large pools or tanks of almost stagnant water surrounded by dense masses of reeds and bushes. It is a most notoriously malarious country, and while there I examined all children under the age of 12 and found that the splenic index was sixty-nine per cent.

The Transjordan Frontier Force at Azrak consisted of headquarters, "A," "B" and "C" Companies. As soon as the operations were over, the force returned to its headquarters at Zerka in the following order: Headquarters and "B" Company, May 25; "C" Company, July 5; "A" Company, July 31.

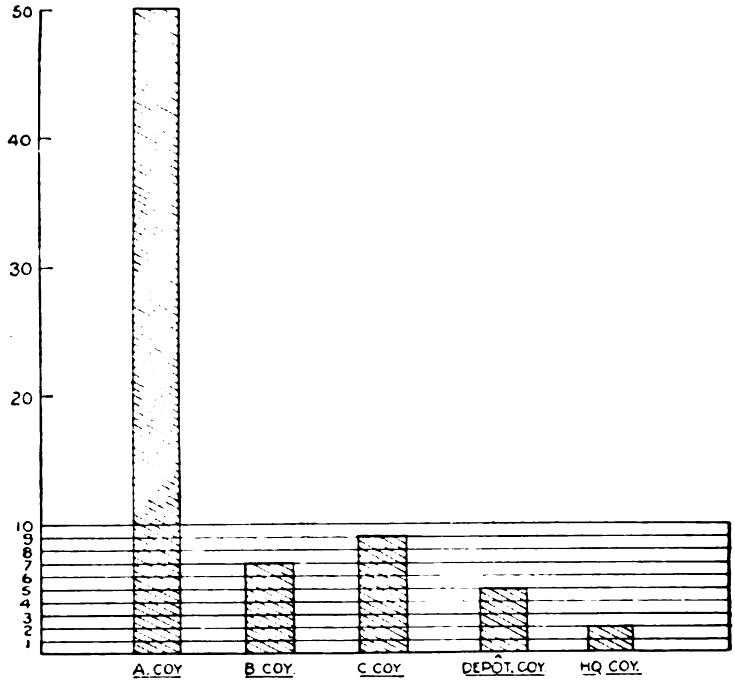
During the period May 25 to July 31, there were four cases of malaria at Azrak.

Now Zerka, the headquarters of the Transjordan Frontier Force, is undoubtedly a very malarious place. The splenic index, in the village, of children under 12 being forty-three per cent. The breeding occurs along the bank of the river Zerka, and also in the seepage from irrigation channels, which lead from the river to the various fruit and vegetable gardens. Every effort is made to keep this breeding in check by canalization, Paris green and oil, and very few adult mosquitoes are found in the camp. The two anophelines found were *A. superpictus* and *A. sergentii.*

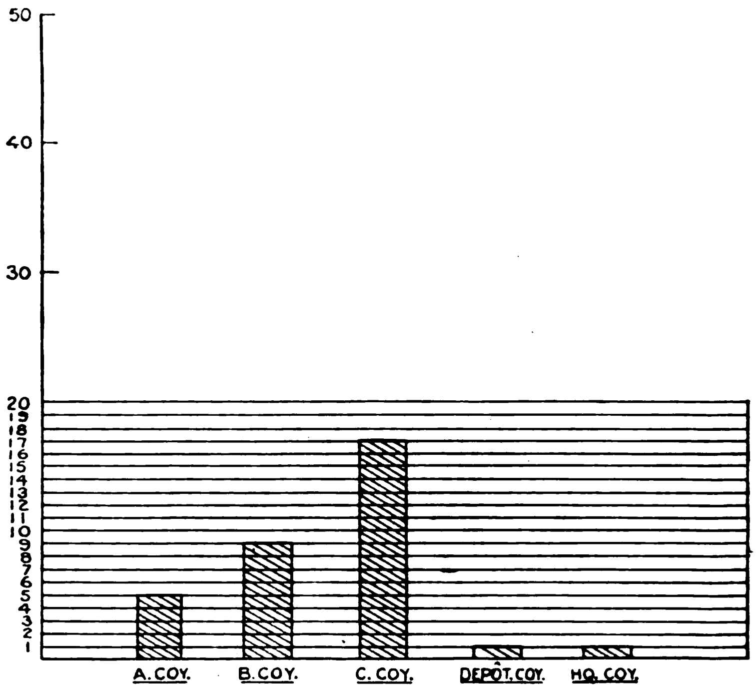
On August 20 patients were being admitted to hospital in Zerka at a somewhat alarming rate, and between that date and September 10 seventy-one men were admitted with malaria out of a total strength of 600.

An analysis of the location of these cases showed an enormous preponderance of men from "A" Company who, as it will be remembered, were the last to leave Azrak, i.e., on July 31.

As will be seen by the accompanying chart, the number of cases occurring in each company shows a direct relation to the dates of their return from Azrak, companies being approximately of the same strength :—



Before commencing early malarial treatment with "A" Company



After commencing early malarial treatment with "A" Company.

It appeared to us then that as "A" Company had returned last from Azrak, when mosquito breeding was at its height, in all probability the whole company was infected with the malaria parasite, so on September 10 it was decided to put the whole company on quin. sulph., in liquid form, ten grains morning and evening. The results fully justified this. From September 10 to October 10 "A" Company had five cases, against fifty that attended from August 20 to September 10.

When this quinine treatment was commenced it was realized that the treatment was not prophylactic, but should rather be regarded as early treatment, on the assumption that though the patient was infected, the parasites had not yet reached sufficient numbers in the blood to cause clinical symptoms. It was therefore considered necessary to give a modified full course of quinine so that twenty grains per diem was continued for ten days, and then twenty grains two days a week for three months. This course is still being continued.

The accompanying chart is self-explanatory, and indicates, I think, that the majority of these cases were infected in Azrak. I would be very glad of any opinions on this, for as Zerka is the permanent headquarters of the Transjordan Frontier Force, it is of course a very important point.

I am indebted to Lieutenant-Colonel F. W. Bewsher, D.S.O., O.B.E., M.C., O.C. Transjordan Frontier Force, for kind permission to publish these notes.

A NEW USE FOR OIL DRUMS.

By Major P. G. M. ELVERY, D.S.O., M.C.

Royal Army Medical Corps.

Where there are oil companies it is always possible to obtain oil barrels. These have been made use of at Karachi in the embarkation compound for boilers and refuse bins.

The first photograph shows that out of these oil drums three very satisfactory boilers were constructed for the troops' kitchen, the capacity of each boiler being forty-five gallons (for boiling forty gallons). Two of these were used for boiling water and one was used for cooking potatoes. Five hundred and nineteen pounds of potatoes can be boiled in one boiler at one time. Usual time one hour with wood fuel.

In the second photograph, an oil drum is shown as a dustbin. The advantages of this are: first, self-cleaning; second, self-emptying. By lifting up the handle catch and rotating the handle the drum turns over, the lid opens and the contents are thrown into the sweeper's basket placed under the bin, or the contents are thrown out on to the asphalt base and swept up for removal.

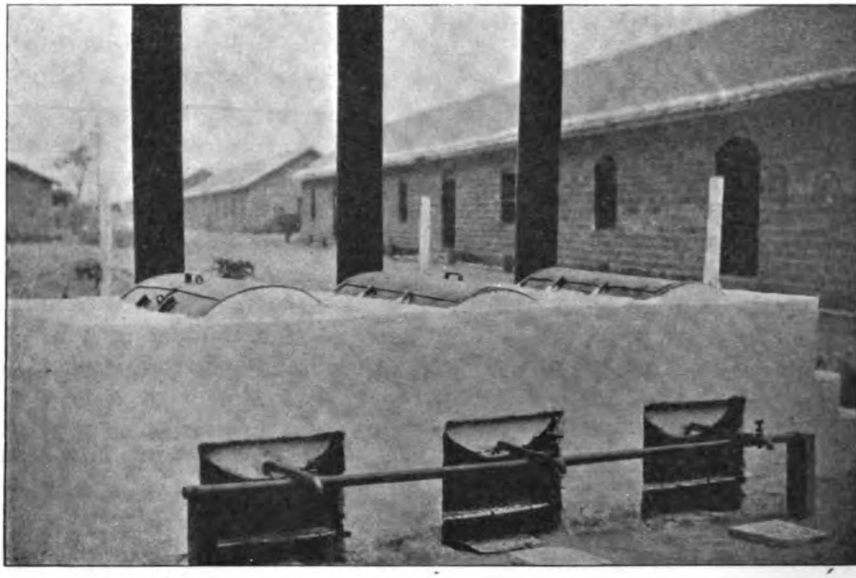


FIG. 1.

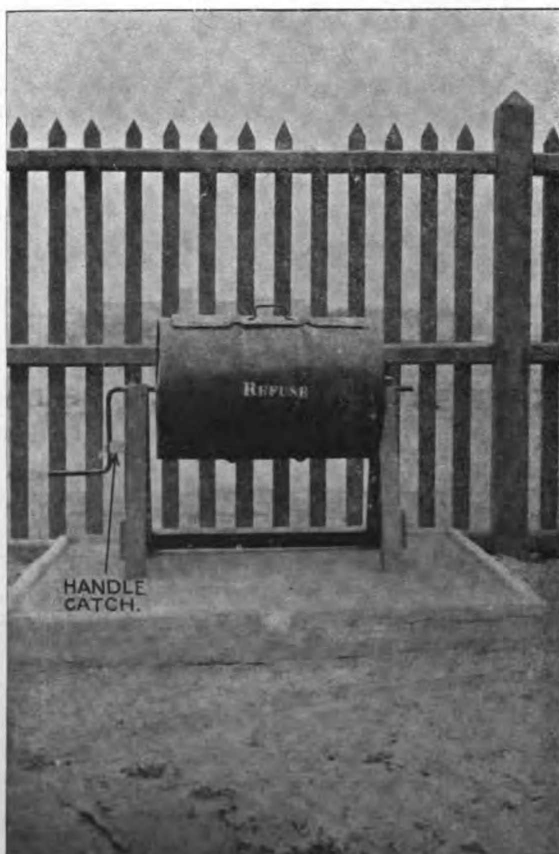


FIG. 2.

Travel.

KULTUR AND KUR IN A COUPÉ.

By U. P. A.

(*Continued from p.* 70.)

The Bavarian Highlands.—Passing through Frostberg and Altenmarkt we came to Frauenstein, at the base of the great ranges which occupy the Tyrol.

We pulled up in a neat little market place, and rested under the trees. I wanted to compose a poem, but Georgina dragged me off to explore, and to choose—and carry—the ingredients of a substantial lunch.

Bavarian mountain air increases one's appetite.

The road skirts the east and north shores of Chiem See and then climbs sharply to a vantage point from which a splendid panoramic view of this lovely lake may be obtained.

From here progress was slow on account of the bad state of the roads, but the scenery was superb. Eventually we arrived at Tegern See via Rosenheim and Miesbach, after a run of 106 miles.

There is a good hotel in Tegern village. We sat in the garden, at the water's edge, for a time, and watched the sun sink behind the mountains on the other side of the lake. Georgina asked for tea. The waiter said he would bring us a real *English* tea. The beverage was good, but it was a mere accompaniment; *the* item was a big platter of cold ham and tomatoes!

Next morning we started off with the intention of driving round Tegern See. The attempt was foiled by gangs of men who were pouring oil and tar over long stretches of road, from one side to the other; an uncommon procedure in Germany. We turned and found a switchback road which carried us into Bad Tölz.

Bad Tölz is a crazy place. The houses are painted in colours which defy the rainbow, and they look as if they were made of *papier-mâché*.

The attractions of the place include iodine springs, and trips on rafts on the river Isar.

The road now skirts the Benedictine Forest until Kochel See is reached, at a height of 1,950 feet. From this little lake there is a sharp ascent over some three miles, to a height of 2,930 feet.

Recently this piece of road has been reconstructed for motor traffic. The work has been done so well that you may let the car run all out in perfect safety.

From the top of the hill the view is wonderful. Walchen See, in a cup

in the mountains lies spread before you, 300 feet below. Impossible to imagine anything more beautiful. Impossible to describe.

The coupé descended in spirals to the lake shore, where we dallied and had difficulty in deciding to leave.

The road runs along the western edge of the lake and ascends a typical Tyrolean valley amidst towering forests and cascading streams.

At Mittenwald on the frontier we turned, climbed 3,060 feet, descended to 2,340, and entered Garnisch-Partenkirchen. The adjacent mountains seem to have squeezed the streets into mere strips between the rows of houses.

Thence to Eschenlohe; over great, open, rolling stretches in the foothills between Lakes Staffel and Reig; and, after a splendid run of ninety-two miles, into Weilheim, just in time to escape a furious storm of wind and rain.

Our shelter was a gasthof and brewery combined; a clean, honest, hospitable tavern.

The big coffee room was panelled and roofed with wood, well fumed by the smoke of countless cigars.

Dozens of heads and antlers adorned the walls and hung suspended as chandeliers.

The head waiter, in peasant's full dress, with frilled shirt, shorts and Homburg complete, helped us to choose a meal. He did not seem to think much of Georgina's German, for, by way of suggesting roast chicken, he stood on his toes, flapped his arms and crowed vigorously.

We were left in no doubt as to his meaning.

However, he failed to imitate a compôte of fruit.

Rolling Home.—On August 12 the coupé ran on a good road across the great upland plain of Lechfeld, via Landsberg, to Augsburg-am-Lech.

This town contains some fine Renaissance architecture in the Golden Rathaus, several churches, and some patrician houses.

Kultur is evident but not blatant. To the visitor that is a great comfort and not as common as it should be. Fritz likes to have Kultur pushed at him; but the average Englishman prefers to look for it in a leisurely way and in his own time.

Via Burgau and Günzburg we came to Ulm, the speedometer registering ninety-two miles for the day's run.

Ulm is full of old buildings of every description, some humble and quaint, others pretentious, and a few very handsome. Most of them, and especially those privately owned, are painted in crude colours which clash with each other in a grand camouflage outrage. Magenta, spinach green, salmon pink, saxe blue, bilious yellow—a fearful and wonderful medley. Ugh!

But this is sad, for Ulm enjoys a fine site on the Danube, and contains streets, squares and edifices which deserve better treatment.

The cathedral, with its lofty spire, is a very graceful and ornate Gothic structure.

The interior of the cathedral (now of Protestant denomination) is more like a secular hall than a church. The effigies of the apostles and saints have been replaced by spick-and-span statues of poets, painters, philosophers, musicians, statesmen and warriors. They are arranged in two ranks, one on each side of the nave, facing inwards and dressed by the right with Prussian military exactitude. There is also a great deal of stained glass, all secular, and, like the statues, to the glorification of modern Germany. Many of the panes feature Bismarck, Moltke the elder, and similar great personages in the history of the Fatherland ; but the majority of the panes feature the ex-Kaiser, who in this setting looks anything but a saint.

The contrast between the outside and the inside of this ancient cathedral gives one a shock.

There is a large garrison at Ulm. Many of the men we saw had the appearance of recruits ; but they were not nearly so smart and clean looking as the British variety.

The sentries lounged up against the barrack gates, their steel helmets awry and their rifles carried anyhow. Sometimes even the rifles lounged!

If a few Green Police sergeant-majors were seconded to Ulm they would have a busy time ; so would the garrison.

On August 13 we drove for ninety-nine miles through typical Schwabian scenery.

This district would be a motorists' paradise were the road surfaces satisfactory. On this day they were nearly all bad, and bumped out of us a good deal of the joy of living.

Near Heidenheim there is an interesting castle, Hellenstein. Aalen, in the Kocher Valley, possesses a picturesque rathaus.

Ellwangen, on the Jagst, was an "Imperial Abbey" until 1460, and the residence of a Prince-Prior until 1802. There is a Romanesque convent church with three towers (eighth to twelfth centuries), a Jesuit church (1724), and a big schloss. The best feature is a fine pilgrimage church of the seventeenth century, which stands on the Schönenberg, a short distance from the town.

Passing through Crailsheim, Blaufelden and Bartenstein, the coupé emerged from a dense forest, topped a ridge which afforded a glorious view, and began the long descent into Mergentheim-am-Tauber.

Bad Mergentheim is known as "The German Karlsbad." "Highly recommended in all cases of diabetes, diseases of the liver, biliary calculus, gout, obesity, diseases of the stomach and intestines, chronic constipation, etc. About 10,000 visitors annually. Population 5,000."

In the matter of comprehensiveness and optimism, Kur literature is hard to beat.

At the hotel we did not notice any signs of diabetes, biliary calculus, or gout. The guests spent a lot of time and energy in jazzing to the strains of an orchestra from Stuttgart.

The members of the orchestra played in tennis flannels, complete with rubber-soled shoes. The kettle drummer had a useful volley, and the bass drummer a devastating smash.

Happily, noise exercises no prejudicial effects on German liver complaints.

The town was *en fête* and full of visitors. This time we did not ask the reason why. We knew: the Annual Reunion and Display of District Fire Brigades.

Measures to prevent spontaneous combustion were in full force; that is to say, enormous quantities of the national beverage were being consumed.

Perhaps Fireman Fritz is immune to diabetes and allied ills.

Once upon a time Mergentheim knew nothing about Kur; it was not always a "Bad." From 1526 to 1805 it was the residence of the Grand Masters of the Teutonic Order, and their old castle, with its extensive Renaissance and Baroque buildings, still stands.

Next day we went to Harthausen, Euerhausen, and Giebelstadt; a farming district with very dusty roads.

Würzburg, on the Main, is a delightful old town. It dates from the eighth century, and, like Bamberg, owes its wealth in architecture and art treasures generally to the Prince-Bishops who used to hold sway here.

The fortress of Marienburg (1650) stands on vine-clad slopes, 400 feet above the river.

It is approached by an old bridge decorated with twelve Baroque statues of saints.

On one occasion we viewed the river, bridge, and fortress by moonlight and the effect was charming.

Neumünster Church contains the tombs of St. Kilian and of Walter von der Vogelweide, the great German poet of the Middle Ages whom Wagner introduces in the "Meistersingers."

However, these are only a few of the attractions of Würzburg.

Once again the coupé was buffeted on an atrocious road through Warneck, Poppenhausen, and Orlenbach, to Bad Kissingen in the valley of the Saale.

Kissingen is one of the most popular of the Bavarian Spas. It used to be frequented by Bismarck. In the saline baths there is a bubbling artesian spring, 290 feet deep. One of the attractions of the place is a new annexe to the Kurhaus; it is called the "Konversationhaus!"

The next stage lay through the Rhön Hills.

The map warned us of trouble ahead, but we did not bargain for cross-country work. The surfaces, gradients, and bends are of the worst possible description; cattle-drawn vehicles are met with everywhere, and, as usual, the most difficult parts of the road lie through villages and hamlets.

Bad Kissingen to Bad Brückenau via Kleinbrach-Hausen and Waldenster should be tackled in a track vehicle or on foot. Nevertheless, the coupé behaved splendidly from start to finish; but the stress of driving gave us little chance of admiring the scenery.

The spa and town of Brückenau adjoin each other. Near the latter is the Kreuzberg, a basalt rock, 2,800 feet high, on which is built a Franciscan monastery.

The remainder of the journey through the Rhön Hills, past Motten, to Bronzell in the Vogelsberg, was hard going, but very pretty. We reached Fulda after a most exacting run of 113 miles.

Fulda was the headquarters of the See of St. Boniface and the residence of the governing mitred abbots. There are several interesting churches and a fine palace standing in beautiful gardens. The Kurfürst Hotel was once the quarters of the knights-in-waiting to the abbots. Its rooms, corridors, and staircases are on the grand scale. Our bedroom was immense and ornate, and contained a number of really good pictures.

When we set out on August 15 we anticipated an easy main road run via Lissberg, Budingen, and Hanau, into Frankfurt.

Twice we were headed off by "Strasse Gesperrt!" and twice we had to make long and stiff climbs up the slopes and through the forests of the Vogelsberg. Still, it was an enjoyable drive: pretty woodland scenery and fine views of the valleys below.

Frankfurt-am-Main contains 500,000 inhabitants; it is Goethe's birthplace; its "old town" is a delight; and it is a city of which any country might be proud. However, Frankfurt is too well known to need, and too big to permit of, description here.

The coupé raced along the dull, albeit tarred, Frankfurt-Mainz road. Soon we re-entered the Zone of Occupation, and arrived back in Wiesbaden after a run of seventy-eight miles.

IV.—The Departure.

The Rheingau.—Within a few days the coupé was on the open road once more, this time bound for Antwerp and home.

You may travel north-west, straight across the Taunus Mountains, via Holzhausen. This is the most direct route; a straight drive over a broad, open road.

Or you may strike due north over the eastern spurs of the Taunus, to Limburg, a pleasant old cathedral town; and thence along the beautiful valley of the Lahn to Bad Nassau and Bad Ems.

Lastly, you may go by the left bank of the Rhine from Mainz or Bingen, to Koblenz. This is the castellated Rheingau, so celebrated in song and story; and this is the route we choose.

The broad-bosomed, busy stream always provides a shifting panorama of bright colour and vigorous movement. Crowded passenger steamers, dressed with bunting, churn the waters to white foam; deeply-laden barges, cleansed and polished like Marryat's frigates, slide along solemnly in the wake of fussy little tugs; commissariat craft of the French Army breast the stream under the tricolour, for all the world to stare at—and for Fritz to curse at.

A riverain hive of industry, with gaiety, colour, and energy enough to please a Frank Brangwyn.

The steep banks, from water level to hill top, are given over to vine growing. In winter the colour is a uniform brown; except for a few isolated trees, not a speck of green is to be seen. But in summer the whole valley is green, or bluish-green, as the plants come to fruition, in readiness to yield the famous Rhine wines.

The culture of the vine is a scientific and exceedingly onerous business. The field workers are poorly paid and, at present, in a chronic state of discontent and unrest.

The Rhinelanders are quite different from the peasants of the Black Forest and Bavarian Alps. The latter are a cheerful, friendly crowd, merry and bright in speech, manner and dress. The former, though civil enough, are sober and reserved; they live and work in a harder environment. Besides, there is the Occupation. . . .

The Rheingau is under forty miles in length, and yet between Bingen and Koblenz there are no fewer than twenty castles and about the same number of towns and villages.

Schloss Johannisberg, on the right bank, near Geisenheim, can be approached from Wiesbaden via the beautiful Niederwald. Nearby stands the great National Monument, above the town of Rüdesheim; while from the middle of the river rises the ancient Maüseturm. Bingen is on the opposite bank, at the confluence of the Rhine and the Nahe.

The Pfalz stands in midstream, opposite Caub. It is a quaint structure, built in 1327 for the protection of the Rhine customs which, in those days, were frequently collected in a vigorous and entirely unofficial way by the occupants of the riverain strongholds.

Burg Stahleck, the castles of Lahneck, Marksburg, and Stolzenfels; the villages of Bacharach and Oberwesel; the Gothic churches, St. Werner's, Frauenkirche, and St. Martin's; the Narrows, where the river flows between precipitous cliffs 345 feet high; and the Lorelei, a solid mass of rock, rises sheer out of the water—a plethora of sights!

The Rheingau is romantic in appearance and history; but, as you read its legends and stories, you doubt if "the good old days" were as good as they are supposed popularly to have been.

In those days Might, and nought else, was Right in the Rheingau.

Bingen is the last British post in this direction.

We ran into Koblenz and saw the French tricolour streaming from the great bridgehead fortress of Ehrenbreitstein, until 1922 the Headquarters of the American Army of Occupation.

Koblenz derives its name from the Roman colony Confluentia—the confluence of the Rhine and Moselle.

It is a pleasing town, with fine boulevards and open spaces; and on the river bank there is a truly colossal equestrian statue of William I.

If you travel by Ostend you may take the Mayen road and cross the

Belgian frontier between Cronensburg and Malmedy, or between Prum and St. Vith.

If by Antwerp the frontier is crossed at Aix-la-Chapelle.

So far as running is concerned there is little to choose between these routes; road surfaces are indifferent, the country is bleak and wind-swept, and the villages and towns—with the exception of Mayen and Prum—are uninteresting.

Mayen is situated amidst extensive woodlands and is a pleasant summer resort. It has a good hotel.

Prum is of considerable historical and architectural interest.

To the Frontier.—Through the old town of Andernach we reached Remagen, where there is an imposing place of pilgrimage, the church of St. Apollinaris. A fine panoramic view may be had from the adjacent Victoriaberg.

Thence north-east up the valley of the Ahr to Bad Neuenahr, famous for the alkaline hot spring, Der Grosse Sprudel.

Via Gelsdorf, Rheinbach, and Euskirchen, we arrived at Düren on the Roer, after covering 132 miles. Here the hotel was only fair and the people just civil. But then—Düren is "Occupied." It is always more pleasant to travel in Unoccupied than in Occupied territory. Although Fritz never loses a chance of talking about the War, he is diffident on the subject of the Occupation. Moreover, when he does mention it, he is an opportunist. Thus, in Wiesbaden we heard about the sins of the French; in Koblenz about the American enormities; and in Malmedy about the Belgian yoke.

There is no doubt that in Mainz they talk about the atrocities of the savage Briton.

Next morning we reached Aix-la-Chapelle (Aachen), famous for its hot sulphur springs; and at present the headquarters of the Belgian Army of Occupation.

Prior to the sixteenth century the German kings were crowned here, and it was Charlemagne's favourite place of residence.

The rathaus is a graceful fourteenth century structure. The cathedral is an extraordinary mixture of comparatively modern work, with thirteenth century gables and a dome-shaped octagon dating from A.D. 800.

At mile 20 we crossed the frontier.

Up to this point the coupé had covered 2,003 miles of rough, hard going, and had suffered one minor breakdown and three punctures—a good record.

It is a thousand pities that the "moderate charges" of British hotel keepers and garage proprietors make bummling out of the question on our side of the German Ocean.

Although the mark has a stable value of 11¾d., charges in Germany are, in truth, really moderate.

Georgina and I hold no brief for Fritz of Flanders. But although we

know nothing of the publicist, the politician or the Prussian, this we do know: that the people who live in the hills and forests, the smiling villages and the mediæval towns of South Germany are not the very worst people in the world.

As for their beautiful hills, wonderful forests, and fascinating dwelling-places—well, go and see for yourself.

You will not be disappointed.

Echoes of the Past

A SURGEON OF THE RENAISSANCE.

By Captain W. J. F. CRAIG.

Royal Army Medical Corps.

One of the treasures in the Royal Army Medical College Library is an original copy of an old work on Surgery, published in the year 1497 at Strassburg. The book which is in Old High German, was written by one Hieronymus Braunschweig, who was also the compiler of other medical works about this time, including one on the distillation of drugs and another on plagues and infectious diseases. The compass of this work on Surgery can be gathered in brief from his foreword and the headings of the six different sections into which the work is divided.

His foreword reads as follows:—

"Here beginneth this book in Surgery which is called the Practice of Wound Surgery of Hieronymus Braunschweig, Surgeon in the Imperial Free Town of Strassburg, as he hath taught it and as he followeth it in his practice."

The work consists of six parts or treatises which are headed thus:—

I. Medical knowledge and what is seemly and the custom.
II. Wounds and their treatment in general.
III. Wounds from head to foot in detail.
IV. Blows and bruises.
V. Fractures, how one sets and binds them.
VI. Medicines, how to make them."

These sections are each divided up into chapters where the subjects are dealt with in detail. The book is well illustrated with woodcuts which are remarkably good, and are in themselves illustrative to a high degree of the practice of surgery of those times.

The chief fame of the book, however, rests on the fact that one of its chapters deals with gunshot wounds, and is the first article ever printed dealing with wounds produced by this then new weapon. A natural

curiosity to read this chapter was readily followed by the desire to read other portions of the book, and these indeed were found in many cases to be even more interesting than the former. The book is beautifully printed in Gothic characters, and although the language is somewhat archaic it is not difficult to understand when one has once become accustomed to the irregularities in spelling and grammar which are treated with the easy carelessness of a man who has not had to learn his mother tongue by means of school tasks. Indeed, Hieronymus himself (in the preface) apologizes for his Latin, the grammar of which he admits is bad, though he says he has read over 3,000 books and converses daily in that language. Unfortunately, also, the present-day names of some of his herbs and drugs are not known. He quotes freely from masters of medicine of ancient and mediæval times, such as Hippocrates, Galen, Razis, Ali Abbas, and others, and so it is difficult to know how much of the compilation is original and how much of the surgery he writes was already known in his time. But this is evident from his work, that he was a shrewd observer and skilled teacher, and withal a kindly soul who was concerned over the sufferings of unhappy wretches condemned to be tortured on the wheel, and concocted draughts for them with the object of producing narcosis. With frequent repetitions he preaches that there can be no healing of wounds without cleanliness. In another place he recognizes that missiles from firearms may sometimes be left to heal *in situ*, and they will be covered over and do no harm. One of the illustrations shows a mal-united fracture being broken to bring about healing in a straight position. This he recommends the patient desires it, and it will be seen later that some of the popular remedies used in the Middle Ages were not always so nonsensical as we are apt to think.

But, to study the work in more detail, let us take for example the aforementioned chapter on gunshot-wounds which reads in its entirety as follows :—

"The 10th chapter of this treatise sayeth, if someone hath been shot with a gun and the powder hath poisoned the wound, or where the ball remaineth where it cannot be seen in the wound."

Item, further :

"If one should be shot with a gun and the ball be unclean and poisoned with the powder, and some of the powder still remaineth there ; be it in one arm or leg or wheresoever the ball hath gone through then shalt thou take a hare's wool? cord and press that through the hole and draw it backwards and forwards leaving no place untouched and thus wilt thou get the powder out of the wound. By doing so the wound will not become foul. Then canst thou put into the wound a wedge of fat spread over and smeared at the same time with hot oil or fat and though it be a ball from a musket or powder or a poisoned arrow yet it taketh all the poison unto itself so that no poison remaineth in the hole to make the wound unclean. Then treat it with good plasters or take of oleum rosarium half an ounce, and of

turpentine a quarter ounce and of powdered camphor a drachm and mix them well with one another and bind over it a little of this. This draweth out the matter and poison. But one must give the patient at all times of Tiriak[1] a drachm with wine therein and steeped in castor. If however, thou wert in the open field where thou mightest very well have no medicines whatever then thou shouldst take goat's or cow's milk. But goat's milk is the best wherewith to wash the wound.

"Further if one is shot with a ball from a gun and the ball is still in the body then enlarge the hole with a knife if it be possible as hath been before described in this book in dealing with arrows and other things. Then thou shouldst have a musket ball tongs and with this thou shouldst neatly and subtly grasp it in the wound, then with this seize the stone and pull it out. If it be such, however, that thou canst not enlarge the wound or cut there then take thou the iron instrument that is called a stork's bill or leek and push this into the wound as far as the ball and bring the ends of the instrument together behind it. Thus the edges of the wound can be separated from each other and so canst thou insert the tongs to take out the stone. But if it were such that thou couldst not find the ball then do as Count Johann von Dockenburg did to the King of Hungary as will be hereinafter described.

"Further I have verily heard of a man, Hans Ulrich, of Baden, who was called to a man who had been shot with a gun. The ball was still within him but none knew where it lay other than that he got pain there in the body thereafter. Thereupon Hans Ulrich from the dukedom of Baden bade him put his arms round his belly and press, and from the pressure and breathing of the man the ball was driven forward into the outermost skin of the belly so that all could perceive and grasp that the ball was there. He thereupon cut on to it and brought it out with the bullet tongs. As many masters who were there present before him can well testify.

"Further if one be shot with a gun and the bullet still remaineth there and thou canst not reach it with the bullet forceps to pull it out, or thou canst not cut down on to it for fear of causing death thereby, altho' knowing where it lieth, then shouldst thou enlarge the wound with a knife and then, having enlarged the hole, take the herb named 'Ehrenpreis,' and also the herb known as 'Mass Lieblein' and mix these two herbs up well one with the other and press this into the wound and bind the wound in the evening over this. Then of a surety wilt thou find it in the morning lying at the wound and verily that is so even if it lieth deeply and is hidden when thou must wait longer and dress it in this wise on other evening, but if it be not deep and lying free at the wound and if the wound be wide then it cometh away the more easily."

In the above the bullet forceps to which he refers several times is an instrument of which there is an illustration in one of the woodcuts and

[1] Tiriak: a favourite remedy in those days for snake bite.

which is a combination of two pairs of forceps on the same screw, and the outer pair of which has sharp edges on the outside while the inner pair is an ordinary straight forceps. On pressing the outer handles the outer forceps cut outwards on each side, and thus extend the wound ; the inner forceps can then be used as straight forceps to grasp the object. Very similar instruments are in use to-day.

The incident of Count Johann von Dockenburg which he mentions refers to the occasion when the King of Hungary was wounded in battle and the iron point of the arrow was stuck in his arm and could not be located. The arm was bound tightly above the wound which was then painted with a salve of bolus, vinegar, camphor, oil of roses and white of egg. Presumably by means of the congestion and this counter-irritant the iron arrowhead came up to the surface of the arm and was pulled out without forceps.

It is pleasing to learn that the skilful surgeon was raised to the nobility by his grateful patient.

Hieronymus has also much to say that is interesting on the subject of narcosis. In speaking of enlarging a wound to permit of the extraction of an arrowhead he says "if the cutting do him too much harm then give to him this drink, making him drunk, by which he sleepeth and feeleth not the cutting. Take the following :—

Salatrium mortale.
Semen iusquiami (hyoscine).
Papaver albus.
Papaver niger.
Opium thebaicum.
Crocus orientalis.
Cortex mandragora.
Lignum aloes.
Cinnamomus.
Castor.

and from these roots make a powder and take thereof two drachms and soak in Malvasier wine and give it to him to drink."

At another place when speaking of victims of the wheel he recommends a mixture of the following substances :—

"Nightshade
Hyoscyamus
Mohn
Opium
Crocus, and
Mandragora."

It is with little surprise that one learns that in a book published some twenty years ago after the publication of Master Braunschweig's work, the reader is warned against the too energetic administration of this (the second) narcotic as fatalities were resulting therefrom. But we know that about this time professional torturers and executioners were able to increase their emoluments by providing their victims with this as a stupefying drink shortly before the commencement of the official proceedings in return

for a satisfactory financial recompense from the condemned man or his friends and relatives. In these circumstances one hardly expects that the hangman was over careful in measuring out his ingredients, nor would the patient be likely to be over particular even if he had reason to believe that the maximum dose had been exceeded in one or two cases. So that it would not perhaps be altogether fair to blame Hieronymus for these untimely deaths.

What he says in dealing with the treatment of cases taken off the wheel is very interesting. The passage reads, "Where a man has been on the wheel and has been taken off the wheel alive then bury him one day and one night in warm horse dung (Ross Mist) so that the limbs are extended and slightly bent and give to him a cunningly mixed food which is easy to digest and thereafter so bind him each leg separately as I shall teach thee in the fifth treatise dealing with fractures. And if it be the case that his back is broken then should one lay him on an iron table covered over with felt but first bind him with a plaster . . . and a hole should be left opposite the buttocks so that he need not be much moved."

In this torture of the wheel, which seems to have been a very common form of punishment about the time this book was written, as it has a chapter to itself and there are numerous references to it, the victim seems to have been wound in and out and over and under the spokes and rim of an ordinary cart-wheel with the result that all the long bones in both upper and lower limbs were broken, but as the blood-vessels were not as a rule torn, the poor wretch remained alive tied to his wheel until he died of pain and starvation unless he was allowed to be taken down. As regards these latter one sees pictures of them in old woodcuts with the most amazing deformities and progressing by the only method of locomotion left to them, viz., crawling.

There is another method of torture referred to in the book, and by this method people first had their hands tied behind their backs, then they were jerked upwards by a rope tied to their hands so that their arms were over-extended backwards, and heavy stones were tied to their ankles. By this torture the joints, especially the shoulders, were torn and dislocated, and the head of the humerus was often broken off. Speaking of these Hieronymus says that the limbs should be put back into place again as the Henckers (executioners) are so good at doing. It would almost seem that surgery was a minor accomplishment of the hangman of those days.

In dealing with hæmorrhage he teaches clearly the tying of a bleeding vessel in an open wound, but some of his medicinal remedies for arresting bleeding are not so modern. One has the merit of simplicity, and it could not be said that this method would not apply to-day. He says, to stop bleeding, put the patient in the dark so that he cannot see the bleeding, and then tell him it has stopped. This method would appear to anticipate both Christian Science and suggestion. But it is his styptics that really take us with him back to the Middle Ages. One of these remedies recom-

mended by him as a wound powder consists of white incense, aromatic adstringentiun, and powdered eggshell, to which dried and powdered earthworms should be added. The worms should be dried in an oven and made into a powder the moment they are dry enough to allow of this being done. Though this may sound fantastic and absurd, it may not have been without its virtues in those cases for which it was intended, for it would seem at least as reasonable to imagine that extract of earthworm would aid coagulation as to believe that extract of leech could retard it, and this latter we know to be the case. But, nevertheless, one would hesitate nowadays to recommend wrapping in horse manure for the treatment of joint injuries, even though in practice this, too, might be found to have a virtue all its own.

For the resuscitation of the apparently drowned we are recommended the method practised by Ali Abbas, which was to hang the patients up by the feet to let the water run out of them and thereafter to give them vinegar with a decoction of pepper to gargle.

In conclusion, as one might believe from reading the above quotations, the general impression obtained on reading this old work on surgery is that the practice of medicine and surgery in those days, at least in the larger towns, was not so hopelessly steeped in ignorance as we are rather apt to believe.

Doctors of repute, like our worthy Master Braunschweig, obviously taught classes of pupils, as can be seen from the woodcuts alone, and the introduction of printing was proving of great service in standardizing such teaching and spreading it all over Europe. The profession, too, seems to have stood in higher repute at this time than at later periods, and skilful treatment seems to have then held the prospect of rich rewards.

It is therefore no mean thing to have such an old and precious work in our possession, and we should be proud to recognize the worthiness of its writer to a place amongst the immortals of our profession.

Current Literature.

Blondel, R. **Abortive Treatment and Prophylaxis of Influenza by the Oculo-Nasal Route.** *Bull. Acad. Med.* V. 99, No. 8, 255-9.

The author is of opinion that the most common point of contact for the infecting droplets, in the case of particles of saliva and nasal mucus ejected by influenza patients, is the conjunctiva. Furthermore, infections by dust also gain access to the nasal fossæ through the lachrymal duct. He refers to the American method of prophylaxis of hay fever by the use of goggles and of conjunctival applications of pollen antitoxin.

During a severe epidemic of influenza among recruits, he made use of

conjunctival instillations of Roux's antiserum with the object of establishing a temporary local immunity. This was done in addition to the usual applications of antiseptic ointments to the nasal passages and gargling with iodized water. These measures appeared to be eminently successful in the treatment of some cases. The failures he attributes to obstruction to the passage of the relatively viscous serum by swelling of the mucous membranes. For this reason he subsequently made use of a colloidal silver suspension in place of antiserum. When this was used three times daily from the first appearance of signs of infection of the conjunctiva, he obtained satisfactory results. He recommends the same treatment for prophylaxis among contacts, and suggests its application to the treatment and prevention of other diseases, such as measles, scarlet fever, varicella and cerebro-spinal meningitis.

WINSLOW, C. E. A. **Le Lait. [Milk.]** *Rev. d'Hyg. et de Méd Préventive.* 1927, v. 49, 641-62.

Milk ranks third amongst the foodstuffs as a source of energy, second in richness in proteins and in fats. United States hygienists have decided that $1\frac{3}{4}$ pints of milk daily is a reasonable average consumption for man, whereas about $\frac{3}{4}$ pint is the consumption in American towns. There can be little doubt that the general standard of cleanliness in milking is still low, and contamination easily takes place from the flanks of the cow, the fingers of the milker, from flies, from dirty vessels often containing putrefied products remaining from their previous contents. Contamination is very easy in the United States where milk may take several days in transit from the farm to the consumer. The sedimentation test is very useful as an index of cleanliness, and the reducing capacity towards methylene blue forms a reliable rough guide to the bacterial content of the milk. The death rate from pulmonary tuberculosis is about the same in the U.S. and England; the mortality from non-pulmonary tuberculosis (the bovine bacillus accounts for 25 per cent. of these cases in infants) is over twice as high in England as in America. This is due to the higher standard of purity demanded in milk by the U.S. law. It has been shown that the death rate from intestinal and pulmonary tuberculosis in infants varies in different towns with the extent to which pasteurization of milk is carried out. Epidemics of typhoid, scarlet fever, diphtheria and septic angina still arise from infected milk. The author traced a large epidemic of septic angina to a model dairy. The healthy carrier is the great difficulty and one which it is practically impossible to overcome. Summer diarrhœa almost always occurs in artificially fed infants, but whether the disease is due to a specific bacillus in the milk or to some chemical change in the milk allowing abnormal changes in the intestinal flora, is not known. The two chief essentials in the furnishing of a non-infected milk are treatment of infections of the dug (streptococci in fresh milk, especially with the addition of leucocytes, always points to a streptococcal infection of the dug) and

the use of sterilized vessels which are opened as little as possible. Another important point is that milk should be cooled as rapidly as possible to 10° C. after milking. The U.S. Dept. of Agriculture has a system whereby every dairy and farm is graded according to its methods. A total of 40 points is given for equipment and 60 points for method. Local medical committees establish certain standards and give guarantee certificates to milk vendors, which enables them to sell at a higher price. Pasteurization of milk remains the most efficient method of assuring pure milk. Heating of milk to 60—62° C. for 30 mins. destroys all organisms without modifying the cream, or the chemical and physical characters of the milk. The nutritive value of the milk is not affected in the slightest, though the antiscorbutic value is somewhat diminished, but the infant's diet should always contain another source of this factor. The author is convinced that more disease is due to lack of consumption of milk than to the consumption of contaminated milk. Milk should be a national question. The centralization of milk production in large concerns, and the attention of government health departments to the economic side of the industry are necessary steps in assuring a much greater milk consumption and purer milk supply. This article forms a very able and informative survey of the subject, containing many practical details of milk supervision and legislation in the United States.

H. N. H. GREEN.

Reprinted from "Bulletin of Hygiene," Vol. 3, No. 5.

BEATTIE, Margaret. **Use of a Differential Stain in the Direct Enumeration of Bacteria in Pasteurized Milk.** *Amer. J. Pub. Health.* 1927, v. 17, 1031-4. [3 refs.]

Proca's stain was tested and found to differentiate between living and dead bacteria and therefore to be available for the direct enumeration of bacteria in pasteurized milk; Breed's method was modified by spreading the 0·01 c.c. of milk over 4 instead of 1 sq. cm. As finally adopted, 0·01 c.c. of milk is spread over 4 sq. cm. and air dried. The films are immersed for 20 minutes in a mixture of alcohol and ether in equal parts, then air dried and immersed for 1 to 3 minutes in a mixture of 8 c.c. concentrated carbol-fuchsin with 100 c.c. Loeffler's methylene blue (Proca's stain modified by omission of 100 c.c. of distilled water). The bacteria in the dried stained smears are directly counted under the microscope, 300 fields being counted. The films give a bright red background against which the blue (living) organisms show clearly. The dead organisms stain red and blend in the red background. By this method, therefore, a direct enumeration of the living bacteria in pasteurized milk is possible, the original Breed method being useless since the dead bacteria are not differentiated.

W. G. SAVAGE.

Reprinted from "Bulletin of Hygiene," Vol. 3, No. 5.

MEANWELL, L. J. **An Investigation into the Effect of Pasteurization on the Bovine Tubercle Bacillus in naturally infected Tuberculous Milk.** *J. of Hyg.* 1927, v. 26, 392-402, 1 fig. [8 refs.] [National Inst. for Research in Dairying, Reading.]

Only naturally infected tuberculous milk was used, obtained from three cows, one with udder secretion of abnormal appearance, the other two yielding unaltered, or but little altered, milk. The milk was heated in a copper vessel with stirrer and two thermometers and with only slight air access. The copper vessel, closed by an indiarubber bung suitably perforated for the above, was totally immersed in water at the requisite temperature.

Series	Treatment	Material inoculated	Guinea-pigs inoculated	–	+
I	145° F. for 30 min.	Centrifuged deposit and cream	118	103	1
IA	145° F. for 30 min.	Coagulated material from cooler	38	33	1
II	140° F. for 30 min,	Centrifuged deposit and cream	100	96	0
III	140° F. for 20 min.	Centrifuged deposit and cream	66	47	1
IIIA	140° F. for 20 min.	Coagulated material from cooler	6	3	1
IV	138·8° F. for 20 min.	Centrifuged deposit and cream	12	0	10
IVA	138·8° F. for 20 min.	Coagulated material from cooler	6	3	0

The pre-heating to raise the milk to this temperature only occupied 1½ minutes, while cooling after pasteurization was immediately done. The centrifuged deposit from as much as 200 c.c. was used for guinea-pig inoculation. In all, 84 separate experiments were carried out. The above table gives a general summary of the findings.

The 47 guinea-pigs unaccounted for died of non-tuberculous infections in less than 100 days.

The author concludes that 145° F. for 30 minutes does not invariably kill the tubercle bacillus in naturally infected milk. A study of the individual experiments shows that in 2 out of 39 at 145° F. for 30 minutes, or 5·1 per cent., tubercle bacilli escaped destruction; while with 20 minutes at 140° F., 2 out of 17 remained infected, or 11·8 per cent. In the 25 experiments at 140° F. for 30 minutes no positive results were recorded.

W. G. SAVAGE.

Reprinted from "Bulletin of Hygiene," Vol. 3, No. 5.

RAUTMANN, H. Der praktische Wert der Dauererhitzung der Milch auf 63-65 .Grad Celsius für die Tuberkulose-Bekämpfung. **[The Value of Milk Pasteurization at 63-65° C. for the Prevention of Tuberculosis.** *Ztschr. f. Fleisch- u. Milchhygiene.* 1927, v. 37, 185-9.

The injection of suspected milk into guinea-pigs affords a far more sensitive test of the presence of tubercle bacilli than does the giving of the milk by mouth. The author obtained negative results by feeding a heavily infected milk to a series of guinea-pigs, but after spraying the same dried milk into the animals' cages, 4 out of 5 developed tuberculosis.

The injection method was used to determine the efficiency of low-temperature pasteurizing plants in destroying tubercle bacilli; 57 samples of pooled raw milk from 8 dairies were tested on different occasions, and 44 of them were found to contain tubercle bacilli. The same number of samples was taken of the milks after they had been pasteurized in the commercial plants, and only two contained tubercle bacilli. The modern type of pasteurizer employed relies on the maintenance of the milk at a temperature of 63-65° C. for 30 minutes [SEELEMANN, this *Bulletin*, 1927, v. 2, 481], and each plant should have a self-recording thermometer to ensure that the temperature does not fall below 63° C. during the 30 minutes. In the case of the two milk samples in which tubercle bacilli were found, no such device was used, and it is possible that the temperature fell during the heating period. The author is convinced that low-temperature pasteurization, properly employed, can be relied upon to destroy tubercle bacilli.

S. J. COWELL.

Reprinted from "Bulletin of Hygiene," Vol. 3, No. 5.

Reviews.

THE FUTURE OF THE BRITISH ARMY. By Brevet Major B. C. Dening, M.C., R.E., Bertrand Stewart Prize Essayist, 1924. London: H. F. and G. W. Witherby. Pp. 224. Price 10s. 6d.

According to Napoleon, "There exists but one figure of speech for the crowd—repetition."

The author of "Æsculapius Armaque" makes use of this method. In his book you will notice reiteration of this piece of advice: "The lines along which medical units of land forces will evolve themselves must be parallel to the lines of evolution of the forces themselves. It is necessary for a medical service to be informed regarding new warlike inventions and to be *au courant* with military thought and changes in military organization. It must keep a close watch on what the rest of the Army is doing."

This is a sound reason, and a good starting-point, for studying "The Future of the British Army."

At present there are only a few fortunate officers of the Royal Army Medical Corps who come into actual contact with the theory and practice of military transition. The great majority of our officers feel that they are out of the picture. They gather that the transition threatens to be so revolutionary as to be beyond the effective grasp of any but the specialists on the spot; and—remembering the record of the Corps in The War—they go to bed with the comforting thought that "it will be all right on the night."

Well, it may, or may not, be all right. But this is certain—if anything

at all in war can be certain—that, next time, it will not be possible to conduct panel practice in the trenches or to run huge nursing homes at rail-heads.

Therefore, it behoves us to try to penetrate the smoke-clouds, the poison gases, the fumes from countless exhausts; to take the measure of all these noxious vapours while yet there is time, so that they may not overwhelm us in the opening stages of the ordeal.

And there is no dearth of clever and capable sponsors. Take Mr. H. G. Wells, or Lieutenant-Colonel J. F. C. Fuller, C.B.E., D.S.O., in his earlier essays: here is vision stiffened by science. Or the brilliant band of contributors to *The Fighting Forces*: optimism backed by conviction. Or Colonel Fuller in his later writings, Major G. Le Q. Martel, D.S.O., M.C., R.E., and Major Dening: enthusiasm steadied by knowledge.

All have this in common: that, when they have induced you to venture on the ice, you feel that the sheet will crack and open beneath you; but, to your surprise and delight, the farther you follow them, the firmer and smoother does the surface become. Presently you find yourself a long way from the shore, cutting figures of eight, skimming on an outside edge, thoroughly enjoying yourseif and quite forgetful of the fact that, after all, it *is* ice—and ice of an unknown thickness.

It is now time to rest awhile: to gather breath and take stock of your new surroundings. To do this, seek that firm, rocky islet known as "Memorandum on Army Training: Collective Training Period." There you will find an Ice Report couched in serious, sober terms. Read it, and your skating will give you even more pleasure than before. Your blades have been adjusted by caution and sharpened by criticism. Moreover, you are fortified by an assurance that the ice will not give way—indeed, it will become stronger and stronger as the years roll on.

Never lose sight of your islet because, for ways that are persuasive and for tricks that are intriguing, the modern "mechanistor" is peculiar, irresistible and immensely entertaining, a seducer, in fact. Add to this his knack (or is it his right?) of speaking with the authoritative voice of Marshal Foch when he says: "Whatever success I have had must be attributed to my work. My study has been arduous for years, and it proved sufficient to give me the confidence that what I do is right and stick to it." You will realize now what sort of company you are in.

Major Dening refers to your initial fears in a section headed: "Some Psychological Obstacles." In a well written book this is a particularly well written and disarming portion. It bristles with pregnant sentences and is full of matter for thought.

"In the case of an armed force, the influence of conservatism is particularly important, for a false appreciation of the advent of a new factor may well not only involve excessive loss of life and material in actual war, but may be the cause of a major national disaster.

"On the whole it is to be feared that the weaknesses arising out of

conservatism have greater influence at any given time than the strengths."

This may be the voice of post-war youth, but it sounds uncommonly like the voice of post-war wisdom.

In discussing mergers, the author reverts to this obstacle of conservatism, and considers that the difficulty can be overcome satisfactorily by continuing the double nomenclature plan, e.g., 17th 21st Lancers. He errs in taking it for granted that this plan is universally, or even generally, approved—except, perhaps, by its inventors. So now we are faced by the prospect of the advent of the Argyll and Sutherland/Seaforth Highlanders Tank Battalion; and the Oxs. and Bucks./Bedfs. and Hertfs. Armoured Car Company. Cheerful. That is the worst of the petrol engine: it has no heart, no soul; and, naturally, its intimates tend to fall into line. Let us hope that the *Punch* cartoon in the issue of March 21 has killed this kind of compromise for good and all. Even Major Dening says that: "A solution by compromise can too often be a solution of weakness."

India (north-west frontier zone excluded) is treated too temperately and tactfully. That is not the fault of the author; anyone who has served in that conservative country will sense what Major Dening would say if, perchance, he might. However, he does let himself go on the subject of Light Artillery. One dares to prophesy that the four Light Brigades will be abolished long before the Indian difficulty is surmounted.

Light Artillery is not the only part of the Army which Major Dening proposes to axe. With the exception of units in the north-west corner of India, and a few corresponding feeder (Cardwell) units at Home, the author advises big, all-round cuts in personnel and total abolition of horsed transport. Then, in spite of *complete* mechanization, there would result a drop in the Army Annual Estimates by as much as £520,000 per annum; and—" It is within the realms of possibility that in a not too distant future Army estimates may be reducible by between £4,000,000 and £5,000,000, while at the same time an Army is produced in keeping with the changed conditions of war."

In view of this, it is a relief to read that no reduction in the vote for medical services is contemplated.

Major Dening's exposition of the financial aspects of the matter forms a powerful and significant argument in favour of the projected transition. From the political standpoint, no more powerful and significant argument could be adduced. But, from the personal—well—when you buy a car the salesman tells you it will cost £20 per annum to run. Your friend says £40. You soon discover that the actual figure works out at £80. Unfortunately, we are not inured to dealing in millions; we have no means of proving, or disproving, our author's statements; he holds all the cards—very good ones they are too—and we can only hope that his figures are correct. We can do no more than wait and see.

The tactical reasons given for transition are well marshalled and very convincing; but here, again, we can but wait and see, while praying that

our author, as the interpreter of what the future holds in store, may be right. Confirmation or confutation, victory or defeat, cannot be determined beyond doubt until Major Dening's petrol panacea is put to the last—the supreme—test : battle.

The advocacy of oil fuel production from our own great coal reserves —a production to be subsidized, if necessary, out of the defence budgets—is as sensible as it is timely.

The statement that small, highly mobile armies will move at the rate of 100 miles per day is as inspiriting as it is encouraging.

But the omission of "Sanitation and Hygiene" from the list on page 33 is as astonishing as it is inexcusable in an author of this calibre. The list purports to contain the salient features which, on land, governed the conduct of the Great War.

All writings on the subject of transition either avoid the medical services altogether, or refer to them *en passant* in vague, complacent terms. "The Future of the British Army" is no exception. The reasons for this need not detain us; we know them; we merely note the inadequacy and, with a good-humoured smile, read about the death-dealing qualities of this mechanical force which, for aught we are told to the contrary, must be endowed with a charmed life. That is a criticism—not a complaint; but it serves to impress on us the urgent necessity of studying, and of thinking about, the opinions and experiences of those combatants who are now working at this tremendous task.

So, in confidently and strongly recommending "The Future of the British Army" to all officers of the Corps, one ventures to suggest to them that, if they will try to find solutions to problems such as the following, the exercise will prove to be at once interesting and profitable :—

(1) Can it be possible that "there appears to be no reason why a change need be made in the organization of the medical services of a corps or division beyond the substitution of 'carrier' type ambulances for horse-drawn ones, and motor transport vehicles for limbers?" (p. 136).

(2) A special section is devoted to the engineers of the division, wherein it is advocated that a mechanized field company be permanently associated with each brigade as brigade troops (p. 121).

Should mechanized field ambulances conform?

(3) Stress is laid on the necessity for development and mobility of the signal service, especially wireless (p. 133).

In this direction, what provision should be made for the medical units?

(4) Should medical aid for the future cavalry division be based on the division, the brigade, or the regiment? (p. 139).

(5) In view of the recent debate in the House on amalgamation, etc. (March 27), the author's opinions on unification of *all* military-medical services are interesting (p. 194, *et seq.*).

Will wholesale transition affect the case?

An important and ever-increasing school of thought in the Army is visualizing a colossal change.

The result of this change will be profound.

Unless we solve our own special problems in good time, one cannot but think that, one fine day, public opinion will receive a terrific shock.

It is bad enough to pile up a long list of killed; it is infinitely worse to delay in the collection, treatment and evacuation of wounded; or, at least, that is what the public will say. And you cannot improvise medical organization and tactics at the rate of 100 miles per day.

Hence the value of a book of this kind; all who read may learn, whether there are tanks in the vicinity or not.

Major Dening has deemed it politic to avoid a discussion on chemical warfare. Also he has said very little about the difficulties and dangers which a completely mechanized force would encounter, were it faced by an enemy specially trained in, and equipped for, anti-mechanical fighting.

Otherwise, this is a clear and comprehensive thesis; readable, well printed, and containing few errors. Still, "superceded" on pp. 102 and 192 might, with advantage, be superseded by the word as spelled on p. 199.

The printer's notice on the paper wrapper is rather poor stuff. One would prefer something like this, in bold type:—

"NOBODY BUT A FOOL TRUSTS TO HIS OWN WAR EXPERIENCE."—*The late Field-Marshal Earl Haig.*

A.

BEHIND THE BRASS PLATE. By Dr. A. T. Schofield. London: Sampson Low, Marston and Co., Ltd. Pp. 310. Price 15s.

Dr. Schofield has published under this attractive title an interesting volume of reminiscences and recollections. It can be opened anywhere and read straight on, as it is not divided into chapters, but subjects. The author explains in his preface that it is not an autobiography, nor even extracts from any diary or journal. Actually, it is a book of jottings, a series of short chapters on diverse subjects that have interested him during a long and usefully spent life which began in the year of grace 1846.

He had the good fortune to meet many of the interesting personalities of Victorian days. As a chronicle of that epoch, now consigned to history, his book gives the reader an excellent idea of social life in London and in the country during the latter half of the nineteenth century; it is from a perusal of reminiscences of this kind that one realizes how the manners and mentalities of individuals and classes have changed during a few decades. Dr. Schofield obviously kept well in the swim of social and scientific development taking part in many activities and seeing much of the world. His opinions are definite, his anecdotes good, and the subjects he discusses are remarkably diverse. He paints a life-like picture of his times and the people with whom he came in contact during half a century of medical practice, and relates many humorous and original stories.

M. B. H. R.

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Original Communications.

NOTES ON SOME PRELIMINARY OBSERVATIONS ON VACCINATION AMONGST RECRUITS AT WOOLWICH (ROYAL ARTILLERY DEPOT).

BY M. D. MACKENZIE, M.D., D.P.H.
Medical Officer, Ministry of Health.

IN connexion with the severity of reaction resulting from vaccination and the consequent expense involved in the admission of men to hospital, it was decided at a meeting held at the War Office in September, 1926, to carry out an investigation of the possible causes of undue reaction to vaccination as exemplified in recruits. Summaries of the interviews and correspondence leading to this decision are on the files of the Ministry of Health Vaccination Committee. Details of the work were arranged between Lieutenant-Colonel Watson, D.A.D.H., Eastern Command and myself at a conference at the Headquarters of the Eastern Command on September 13, 1926, when it was decided to carry out the investigation at the Royal Artillery Depot at Woolwich.

The recruits joining the Royal Artillery are men of good physique, aged from 18 to 25 (the great majority aged 18 to 21), drawn from all parts of the British Isles and representative of a great variety of trades. All recruits are vaccinated within twenty-four hours of joining the depot by an officer of the Royal Army Medical Corps at the Medical Inspection Room, Woolwich.

Inquiries are made as to previous vaccination or small-pox, an examination for old vaccination scars or evidence of small-pox being carried out at the

same time. Recruits who deny previous vaccination or small-pox and upon whom no vaccination scars can be found are regarded as primary vaccinations, and are subsequently vaccinated in four insertions. The remaining recruits are regarded as revaccinations and are vaccinated in three insertions only. The ordinary routine for vaccination followed at Woolwich at the time of my first visit (September, 1926) was as follows: An area on the upper part of the left arm, about the point of insertion of the deltoid, was cleaned with methylated spirit on a pledget of cotton wool by an orderly and allowed to dry. The scarifier, a small flat vaccination lancet, was then sterilized by heat in a spirit flame and put aside to cool. The lymph, which was supplied from the Government Lymph Establishment and is always used within the prescribed period, was expelled from the tube by an orderly who after breaking off one end of the tube warms the other end, and allowed the lymph to fall on the expanded end of the now cool sterilized scarifier which he then handed to the medical officer. The lymph was thus conveyed to four places on the cleansed arm in the case of primary vaccinations or to three places in the case of revaccinations. The medical officer then made a series of scarifications in each drop of lymph, with or without cross-hatching. The lymph was then gently rubbed in with the flat of the scarifier, and the arm allowed to dry. Later a dressing of lint retained by strapping was applied by an orderly. A record of the name of the man, his previous vaccinal state, the number of scarifications made, and the lymph used was kept by an orderly. The man was next seen on the eighth day after vaccination when the arm was examined by a medical officer, and the result of the vaccination interpreted and entered in the record book. Ordinarily a fresh dressing was then applied and the man was not seen again.

Instructions as to further treatment, admission to hospital, exemption from duty and subsequent visits for examination were given by the medical officer in cases showing severe reaction or presenting any constitutional symptoms.

The present report is essentially of a preliminary nature and deals with observations on some 180 recruits who were vaccinated and subsequently visited the medical inspection room daily for a period of ten days (excluding Sundays), where they were seen by Captain Elkington and myself. Measurements of the lesions appearing at the site of scarification were made with a pair of dividers and a millimetre scale every twenty-four hours and were recorded. Each areola or vesicle was measured first in the vertical diameter, and secondly in the horizontal diameter. The figures given in the report were obtained by multiplying these two measurements together, the result being given in square millimetres. Whilst this method may not give the actual area of the areola or vesicle, it appeared, for comparative purposes, to be the most practical way of measuring vaccinal areas, and as long as it is used for comparison only it seemed to be sufficiently accurate for at any rate the preliminary general observations.

Before discussing the observations in detail, it is necessary to point out certain fallacies which are unavoidable but which, as they occur in each group in which the cases under consideration naturally fall, appear to be to a certain extent negatived for comparative purposes in the final result. The first of these possible errors is the denial by the man of previous vaccination or recent revaccination. This may be due to the fact he has forgotten whether or not he has been vaccinated or revaccinated, or may be due to his wish to conceal the fact (e.g., deserters from other services, released prisoners). Moreover, many men confuse inoculation, either previously in the Army or in civilian life, with vaccination.

A further difficulty occurs in recruits coming from areas known to have been extensively infected with the prevailing type of mild small-pox (e.g., Durham, Northumberland, South Yorkshire and the Midlands). In some cases these men deny having had small-pox, though on questioning them there appears to be definite evidence that they have suffered from the disease. The denial may be due to ignorance of the condition but in others appears to be due to fear of the consequences of not having notified a doctor of their illness, an omission which is constantly occurring in infected areas at the present time.

Furthermore, the possibility of a previous attack of cowpox in men coming from an agricultural area cannot be altogether overlooked.

It is realized that the number of cases examined is small, but the number summarized represents only a proportion of the recruits examined. Some were excluded for the reasons given above as possibly having had small-pox or having been revaccinated, whilst in others the investigation was interrupted by intercurrent illness. A not inconsiderable number were drafted to pack batteries or discharged from the Service before the observations were completed.

Finally, in reading the figures, it must be remembered that measurements of inflamed areas can only be approximate. Each measurement was taken as accurately as possible by myself, but in the case of large lesions on the convex surface of the arm it is impossible to work to the nearest few millimetres. Moreover, it is frequently difficult to determine the exact edge of the inflammatory area, and furthermore, this edge often varies temporarily from the rubbing of the arm just prior to measurement, to blanching of the arm due to excitement at the time of measurement, to existing skin lesions such as acne, and to other causes.

At the time of my initial visits a scarletiniform rash was occurring in nearly seventy-four per cent of the recruits vaccinated. This rash appeared commonly on the fourth or fifth day (earliest second day and latest eighth day) after vaccination. The rash was in the majority of cases punctate, and except in distribution closely resembled that of scarlet fever. In some cases, however, it appeared as an urticaria. In all cases it gave rise to irritation and pruritus. The distribution varied in extent. In all the cases the upper arm on the vaccinated side was affected, as were in most cases

the axilla, the shoulder, the chest to the middle line of the body and the back to the middle line. In severe cases the whole of the left side of the body, loins, back and abdomen, as far down as the groin, was covered with rash. In all cases the rash was limited by the line of the elbow-joint, and the mid-line of body on both the front and back. The duration was in some cases transient (forty-eight hours), and in others lasted from the third to the tenth day. During the course of the investigation the possibility of the rash being due to the dressing employed was considered. A series of cases with controls were dressed only with lint and bandage, the strapping being omitted and the controls being dressed with strapping in the ordinary way. It was then found that only the cases dressed with strapping developed the rash. This fact was afterwards confirmed by dressing the vaccinated arm with lint and bandage and the other arm with lint and strapping, when the rash appeared on the unvaccinated arm. All cases have since been dressed with lint and bandage only, and no further cases of rash have been noted.

There is no doubt that the intense pruritus of the rash in many cases caused very considerable aggravation of the vaccination owing to the frequent and energetic scratching by the patient that resulted. In addition, vesicles were broken, scabs rubbed off, and the general appearance of the arm, largely due to the erythema of the rash on the arm and shoulders, gave one the impression of very severe vaccinal reaction with secondary infection.

On October 27, 1926, it was decided to try, in place of the several scarifications in each lymph insertion, a single linear insertion of six to seven millimetres in length.

This method was carried out in a series of 254 cases with a similar number of controls done with multiple scarifications. With the multiple scarifications the number of cases noted as severe was 24 out of 254 with 5 hospital admissions, in the cases done with a single scarification there were only 9 out of 254 cases classified as severe with no admissions to hospital. A further advantage of single scarification is the fact that it is easier in these cases to read the result in modified vaccinations than is the case with multiple scarifications where the exuded serum and damaged necrotic tissue may be readily recorded as a modified "take" in a case which is in point of fact a "failure." The results of primary vaccinations as far as insertion successes are concerned were similar to those obtained by multiple scarifications.

In the case of revaccinations, cases that failed to "take" with the single line insertion were afterwards vaccinated by multiple scarifications. Out of 168 insertions only two insertions were noted as having "failed" with single line scarifications and having taken when done with multiple scarifications. In both these cases the result was extremely modified and may have been only an immunity reaction which was slow in subsiding. No vesicles occurred in either case. With regard to the scar obtained by

four single line insertions six to seven millimetres long in primary vaccinations, subsequent measurements proved that the scar area obtained was not less than one half of a square inch. Measurements of the resulting scar areas in the case of single scarifications are in process of being taken and will be summarized in a subsequent report. The fewer severe cases and the absence of hospital admissions in our series of cases, if confirmed by further work, should prove of considerable value from the point of view of both efficiency and economy.

The number of cases vaccinated, primary cases, excused duty, and admitted to hospital for vaccinia during the year 1925 was as follows: (1) Total number vaccinated, 6,015 ; (2) total number of primary cases, 391 ; (3) total number excused duty over forty-eight hours, 62 ; (4) total number admitted to hospital as a result of vaccination, 46.

Observations on the effect of exemption from duty on reaction following vaccination were made both at the Royal Artillery Depot, and simultaneously but independently at the Guards Depot, Caterham. These vaccinations were carried out as described earlier in this report. The routine exemption of men from duty resulted in rather more severe reactions amongst these men than amongst those performing full duties. These results tally with the findings at Woolwich where 100 men were exempted from duty, and a corresponding 100 men were returned to duty immediately after vaccination, as controls. Amongst these men the number of reactions classified as "severe" was slightly more amongst those exempted from duty than amongst those performing full duties. There appears, therefore, to be no advantage in exempting men from duty as a routine after vaccination.

The points specially investigated with regard to immunity fall under four headings :—

(1) The amount of immunity, if any, remaining from primary infantile vaccination in young adults.

(2) The relationship, if any, between the total scar area of infantile vaccination and the immunity remaining in young adults.

(3) The relationship, if any, between the number of lymph insertions made in infantile vaccination and the immunity remaining in young adults.

(4) The value of the immunity reaction.

For the purposes of this inquiry daily measurements in millimetres were taken in a series of 180 cases for ten successive days after vaccination or revaccination (excluding Sundays). Details of the technique employed are given earlier in this report.

In every case of primary vaccination four single scarifications were made (in revaccination three only) approximately one inch apart and six to seven millimetres long through lymph previously applied. A further similar scarification into which lymph was not introduced was made in each case as a control.

In interpreting the results of vaccination the criteria suggested by Dr. J. P. Leake, U.S.A. Public Health Service, have been adopted, viz. :—

(1) Maximum reaction between the first and third day is classified as "immunity reaction" (I.R.)

(2) Maximum reaction between the fourth and seventh day is classified as "vaccinoid reaction" (V).

(3) Maximum reaction between the eighth and tenth day as "vaccinia reaction" (T).

TABLE I.

Groups I, II and III.—Ages 18 to 21.

Group I.—Cases previously unvaccinated (primary cases).
Group II.—Cases vaccinated in infancy but not revaccinated until the present date (November, 1926).
Group III.—Cases vaccinated in infancy and revaccinated prior to November, 1926, or with primary vaccination performed at a later date than infancy.

Analysis to show Day after Revaccination on which a Maximum Reaction occurred.

Group I			Group II			Group III		
Day	Day	Day	Day	Day	Day	Day	Day	Day
10	10		10	8	8	2		
10	10		8	9	8	2		
10	10		8	9	8	2		
10	10		10	9	7	3		
9	10		6	10	10	2		
10	10		9	8	3	3		
10	10		3	3	9	3		
10	10		5	8	5	9		
10	10		10	3	3	2		
10	10		9	8	8	2		
10	10		9	3	9	3		
10			5	3	6	3		
10			4	3	8	2		
10			5	8	9	2		
10			10	3	8	2		
10			9	10	8	3		
10			8	8	6	7		
9			9	10	4	3		
10			10	9	8	3		
10			2	9	8	3		
10			9	10	9			
			2	7	9			
			8	10	8			
			8	10				
			10	3				
			3	7				
			9	3				
			8	5				
			8	4				
			9	9				
			8	2				
Number of cases, 32 Average day, 9·9			Number of cases, 85 Average day, 6·6			Number of cases, 20 Average day, 3·0		

All measurements are in square millimetres. The cases examined are divided into four groups, viz. :—

Group I.—Cases aged 18 to 21 + previously unvaccinated (primary).

Group II.—Cases aged 18 to 21 + vaccinated in infancy but not revaccinated until November, 1926.

Group III.—Cases aged 18 and 21 + vaccinated in infancy and revaccinated prior to November, 1926, or with primary vaccination performed at a later date than infancy.

Group IV.—A small group of boys with varying vaccinal states.

TABLE II.

Group II.—Ages 18 to 21.

(Cases vaccinated in infancy, but not revaccinated until the present date, November, 1926.)

Analysed so as to show the relationship between the total scar area of primary vaccination and the day after revaccination on which a maximum area of reaction occurred.

Areas.

Under 500 sq. mm. Day on which maximum reaction occurred	500-1,000 sq. mm. Day on which maximum reaction occurred	1,000-2,000 sq. mm. Day on which maximum reaction occurred	Over 2,000 sq. mm. Day on which maximum reaction occurred
9th day	10th day	10th day	8th day
9th ,,	5th ,,	5th ,,	8th ,,
8th ,,	4th ,,	10th ,,	6th ,,
8th ,,	9th ,,	9th ,,	3rd ,,
8th ,,	10th ,,	5th ,,	9th ,,
3rd ,,	8th ,,	10th ,,	8th ,,
8th ,,	10th ,,	2nd ,,	8th ,,
7th ,,	9th ,,	9th ,,	3rd ,,
9th ,,	8th ,,	2nd ,,	3rd ,,
8th ,,	9th ,,	3rd ,,	8th ,,
9th ,,	10th ,,	9th ,,	3rd ,,
	8th ,,	8th ,,	8th ,,
	8th ,,	8th ,,	
	10th ,,	9th ,,	
	3rd ,,	9th ,,	
	2nd ,,	3rd ,,	
	9th ,,	3rd ,,	
	4th ,,	3rd ,,	
	8th ,,	10th ,,	
	8th ,,	9th ,,	
		9th ,,	
		10th ,,	
		7th ,,	
		10th ,,	
		10th ,,	
		3rd ,,	
		5th ,,	
		4th ,,	
		8th ,,	
		7th ,,	
		10th ,,	
		5th ,,	
		3rd ,,	
		9th ,,	
		6th ,,	
		8th ,,	
		8th ,,	
		8th ,,	
		9th ,,	
		9th ,,	
		9th ,,	
		8th ,,	
Number of cases, 11 Average day, 7·8	Number of cases, 20 Average day, 7·6	Number of cases, 42 Average day, 7·1	Number of cases, 12 Average day, 6·2

TABLE III.

Group II.—Ages 18 to 21.

(Cases vaccinated in infancy but not revaccinated until the present date, November, 1926.)

Analysed so as to show the relationship between the number of scars of primary vaccination and the day after revaccination on which a maximum area of reaction occurred.

Number of Scars.

One scar Day on which maximum reaction occurred	*Two scars* Day on which maximum reaction occurred	*Three scars* Day on which maximum reaction occurred	*Four scars* Day on which maximum reaction occurred
8th day	9th day	8th day	10th day
8th ,,	5th ,,	10th ,,	8th ,,
9th ,,	8th ,,	9th ,,	6th ,,
10th ,,	8th ,,	4th ,,	3rd ,,
8th ,,	3rd ,,	9th ,,	5th ,,
8th ,,	8th ,,	2nd ,,	10th ,,
3rd ,,	10th ,,	9th ,,	9th ,,
9th ,,	7th ,,	2nd ,,	5th ,,
	8th ,,	9th ,,	10th ,,
	3rd ,,	9th ,,	9th ,,
	8th ,,	8th ,,	8th ,,
	9th ,,	3rd ,,	10th ,,
		10th ,,	8th ,,
		3rd ,,	10th ,,
		8th ,,	3rd ,,
		9th ,,	9th ,,
			8th ,,
			9th ,,
			8th ,,
			3rd ,,
			3rd ,,
			3rd ,,
			3rd ,,
			10th ,,
			9th ,,
			9th ,,
			10th ,,
			7th ,,
			10th ,,
			5th ,,
			4th ,,
			9th ,,
			2nd ,,
			4th ,,
			7th ,,
			10th ,,
			3rd ,,
			9th ,,
			5th ,,
			8th ,,
			9th ,,
			6th ,,
			8th ,,
			8th ,,
			8th ,,
			4th ,,
			8th ,,
			9th ,,
			8th ,,
Number of cases, 8 **Average day, 7·9**	**Number of cases, 12** **Average day, 7·2**	**Number of cases, 16** **Average day, 7·0**	**Number of cases, 49** **Average day, 7·1**

The immunity (as measured by the time taken for the reaction to vaccination to attain its maximum) remaining in men age 18 to 21 + from vaccination in infancy or later revaccination is shown.

It will be noted that in Group II individuals vary in the day on which a maximum reaction appears within wide limits (viz., second day to tenth) and the individual in many of the cases appears to have little immunity as demonstrated by an acceleration of the day of maximum reaction. When, however, we contrast the average day of maximum reaction in these cases with that in the men in Group I (previously unvaccinated) we find that primary vaccination in infancy has served to accelerate the day of maximum reaction from 9·9 to 6·6 (over three days.)

In Group III (previously vaccinated or revaccinated), the average day of maximum reaction is accelerated to 3·0 (nearly seven days, as compared with those not previously vaccinated at all). At the age of 18 to 21 years there appears to be, therefore, a definite amount of residual immunity from primary infantile vaccination. This amount is represented in an acceleration of the day of maximum reaction of over three days.

The relationship between the area of scar tissue of primary infantile vaccination and the immunity remaining at 18 to 21 years of age as shown by acceleration of the day of maximum reaction is shown in Table II. All the cases considered here had not been revaccinated since infancy until November to December, 1926, when the present work was carried out.

As has been noted earlier, the individuals show wide divergence in the day on which a maximum reaction was noted. If, however, after grouping the cases under varying sizes of infantile scar areas, we then contrast the day in the various groups on which a maximum reaction occurred, we find that the day appears to vary in proportion to the area of scar tissue, e.g., cases with under 500 square millimetres, only reached a maximum on 7·8 day, whilst those with over 2,000 square millimetres reached a maximum on 6·2 day.

It appears, therefore, as far as the figures available show, that the cases with larger scar areas have a larger residual amount of immunity remaining from primary infantile vaccination.

The relationship between the number of scars of primary infantile vaccination, and the immunity remaining at 18 to 21 years of age as shown by the acceleration of the day of maximum reaction, is given in Table III.

It will be noted that apart from one scar cases, where the scar area is small, there is little difference in the rapidity of development of maximum reaction between cases with two, three and four scars (7·2, 7·0, and 7·1 respectively). Furthermore, if as in Table IV we analyse all cases with four scars, under groups of varying areas of scar tissue, we find the facts suggested by Table II confirmed, viz., the day of maximum reaction varies with the area of scar tissue (9, 7·7, 7·6 and 5·3). Table III and Table IV suggest that the total scar area produced, rather than the number of insertions made, is the important factor in producing immunity.

TABLE IV.

Group II.—Ages 18-21.

(Cases vaccinated in infancy but not revaccinated until the present date, November, 1926.)

Analysed so as to show the relationship in primary vaccinations with four scars between the total scar area of primary vaccination and the day after revaccination on which a maximum area of reaction occurred.

Four Scars of Primary Vaccination in all Cases. Areas.

Under 500 sq. mm. Day on which maximum reaction occurred	500-1,000 sq. mm. Day on which maximum reaction occurred	1,000-2,000 sq. mm. Day on which maximum reaction occurred	Over 2,000 sq. mm. Day on which maximum reaction occurred
9th day	9th day	10th day	8th day
	10th ,,	5th ,,	6th ,,
	10th ,,	10th ,,	3rd ,,
	2nd ,,	9th ,,	8th ,,
	9th ,,	5th ,,	8th ,,
	6th ,,	10th ,,	3rd ,,
	8th ,,	8th ,,	3rd ,,
		3rd ,,	3rd ,,
		9th ,,	8th ,,
		8th ,,	3rd ,,
		9th ,,	
		3rd ,,	
		10th ,,	
		9th ,,	
		9th ,,	
		10th ,,	
		7th ,,	
		10th ,,	
		5th ,,	
		4th ,,	
		7th ,,	
		10th ,,	
		5th ,,	
		8th ,,	
		8th ,,	
		8th ,,	
		8th ,,	
		4th ,,	
		9th ,,	
		8th ,,	
Number of cases, 1	Number of cases, 7	Number of cases, 30	Number of cases, 10
Average day, 9	Average day, 7·7	Average day, 7·6	Average day, 5·3

TABLE V.

Group I.—Ages 18-21 years (Primary Vaccinations).

Analysed so as to show the average day of the first appearance of the vesicle in cases of primary vaccination aged 18 to 21 years.

Number of cases in which vesicles first appeared on the 4th day was 1.
,, ,, ,, ,, ,, ,, 5th ,, 8.
,, ,, ,, ,, ,, ,, 6th ,, 25.
,, ,, ,, ,, ,, ,, 7th ,, 5.
,, ,, ,, ,, ,, ,, 8th ,, 1.

Total number of cases, 40.
Average day on which vesicles first appeared was therefore 5·9.

Table V shows the days on which vesicles were first noted in a series of primary vaccinations examined daily.

The average day of first appearance of the vesicles was 5·9.

Table VI shows the relationship between the scar area of primary

TABLE VI.

Group II.—Ages 18 to 21.

(Cases vaccinated in infancy but not revaccinated until the present date, November, 1926.)

Analysed so as to show the relationship between the total scar area of primary vaccination and the day after revaccination on which vesicles first appeared (in cases where vesicles developed).

Areas.

Under 500 sq. mm. Day on which vesicles first appeared	500-1,000 sq. mm. Day on which vesicles first appeared	1,000-2,000 sq. mm. Day on which vesicles first appeared	Over 2,000 sq. mm. Day on which vesicles first appeared
7th day	6th day	5th day	6th day
5th ,,	6th ,,	7th ,,	7th ,,
7th ,,	5th ,,	7th ,,	6th ,,
6th ,,	5th ,,	7th ,,	5th ,,
7th ,,	7th ,,	6th ,,	6th ,,
6th ,,	6th ,,	6th ,,	
6th ,,	6th ,,	8th ,,	
5th ,,	7th ,,	6th ,,	
7th ,,	8th ,,	6th ,,	
	6th ,,	6th ,,	
	6th ,,	6th ,,	
	7th ,,	6th ,,	
	5th ,,	5th ,,	
	8th ,,	5th ,,	
	6th ,,	9th ,,	
		6th ,,	
		5th ,,	
		7th ,,	
		7th ,,	
		7th ,,	
		7th ,,	
		5th ,,	
		5th ,,	
		6th ,,	
		6th ,,	
		6th ,,	
		6th ,,	
		6th ,,	
		6th ,,	
		7th ,,	
		7th ,,	
		6th ,,	
Number of cases, 9 Average day, 6·2	Number of cases, 15 Average day, 6·2	Number of cases, 32 Average day, 6·2	Number of cases, 5 Average day, 6·0

infantile vaccination and the date of the first appearance of vesicles after revaccination.

It will be seen that the average day of appearance of vesicles under the various groups of total scar areas is remarkably constant (6·2, 6·2, 6·2 and 6·0).

This is further borne out by Table VII, which shows the relationship

between the number of scars of primary infantile vaccination and the date of the first appearance of the vesicles after revaccination (6·5, 6·4, 6·2, and 6·1).

TABLE VII.

Group II.—Ages 18-21.

(Cases vaccinated in infancy but not revaccinated until the present date, November, 1926.)

Analysed so as to show the relationship between the number of scars of primary vaccination and the day after revaccination on which vesicles first appeared (in cases where vesicles developed.)

Number of Scars.

One scar. Day on which vesicles first appeared.	*Two scars.* Day on which vesicles first appeared.	*Three scars.* Day on which vesicles first appeared.	*Four scars.* Day on which vesicles first appeared.
5th day	7th day	6th day	5th day
7th ,,	6th ,,	7th ,,	6th ,,
7th ,,	6th ,,	5th ,,	7th ,,
8th ,,	7th ,,	8th ,,	7th ,,
6th ,,	6th ,,	6th ,,	7th ,,
6th ,,	6th ,,	5th ,,	6th ,,
7th ,,	7th ,,	7th ,,	6th ,,
	6th ,,	5th ,,	6th ,,
	7th ,,	7th ,,	6th ,,
	6th ,,		5th ,,
			6th ,,
			7th ,,
			6th ,,
			6th ,,
			6th ,,
			6th ,,
			5th ,,
			9th ,,
			6th ,,
			5th ,,
			7th ,,
			7th ,,
			5th ,,
			5th ,,
			5th ,,
			5th ,,
			5th ,,
			6th ,,
			6th ,,
			6th ,,
			6th ,,
			6th ,,
			8th ,,
			6th ,,
			7th ,,
			8th ,,
Number of cases, 7 Average day, 6·5	Number of cases, 10 Average day, 6·4	Number of cases, 9 Average day, 6·2	No. of cases, 36 Average day, 6·1

The figures suggest that the appearance of the vesicles is not subject to the variations shown by the day of maximum reaction in cases of successful revaccination.

Table VIII shows the relationship between the scar area of primary

infantile vaccination and the result of revaccination as measured by the criteria adopted by Dr. Leake. The number of immune reactions at the age of 18 to 21 years is so small as to invalidate the result. In order to estimate fairly the immunity remaining in cases, it is necessary to contrast the number of immunity reactions + vaccinoid reactions with the total number of vaccinias (T.) in each group, i.e., cases in which a maximum reaction occurred after the seventh day.

TABLE VIII.

Group II.—Ages 18-21.

(Cases vaccinated in infancy but not revaccinated until the present date, November to December, 1926.)

Analysed so as to show the relationship between the total scar area of Primary Vaccination and the Results of Revaccination. The readings are based on the work of J. P. Leake, U.S.A. Public Health Service.

T. = Maximum area of reaction on the 8th to 10th day (Vaccinia)
V. = ,, ,, ,, ,, ,, ,, 4th to 7th ,, (Vaccinoid)
I.R. = ,, ,, ,, ,, ,, ,, 1st to 3rd ,, (Immunity reaction)

Areas.

Under 500 sq. mm.	500-1,000 sq. mm.	1,000-2,000 sq. mm.		Over 2,000 sq. mm.
T.	T.	T.	T.	T.
T.	V.	T.	T.	T.
T.	V.	T.	T.	V.
T.	T.	T.	V.	I.R.
I.R.	T.	V.	T.	T.
T.	T.	T.	T.	T.
V.	T.	I.R.	V.	V.
T.	T.	T.	T.	V.
T.	T.	I.R.	V.	V.
T.	T.	T.	T.	T.
	T.	V.	V.	V.
	T.	T.	T.	T.
	T.	T.	V.	
	T.	T.	V.	
	V.	T.	T.	
	I.R.	T.	V.	
	T.	T.	T.	
	V.	V.	T.	
	V.	V.	T.	
	T.	T.	T.	
Number of cases, 10 Average percentage T., 80 per cent V., 10 ,, I.R., 10 ,,	Number of cases, 20 Average percentage T., 70 per cent V., 25 ,, I.R., 5 ,,	Number of cases, 40 Average percentage T., 67 per cent V., 28 ,, I.R., 5 ,,		Number of cases, 12 Average percentage T., 50 per cent V., 42 ,, I.R., 8 ,,

On examining this table we find that the number of I.R. + V. vary with the scar area from twenty per cent in the cases with under 500 square millimetres of scar area to fifty per cent in cases of over 2,000 square millimetres.

Table IX shows the relationship between the number of scars of primary infantile vaccination and the result of revaccination as measured by the criteria adopted by Dr. Leake.

Apart from the cases with one scar where the scar area is small, it will be seen that the number of scars alone appears to bear no constant relationship to the result; thus I.R. + V. in the last three groups is thirty-eight per cent, thirty-five per cent, and thirty-six per cent respectively.

TABLE IX.

Group II.—Ages 18 to 21.

(Cases vaccinated in infancy but not revaccinated until the present date, November to December, 1926.)

Analysed so as to show the relationship between the number of scars of primary vaccination and the result of revaccination. The readings are based on the work of J. P. Leake, U.S.A. Public Health Service.

T. = Maximum area of reaction on the 8th to 10th day (Vaccinia).
V. = ,, ,, ,, ,, ,, ,, 4th to 7th ,, (Vaccinoid).
I.R. = ,, ,, ,, ,, ,, ,, 1st to 3rd ,, (Immunity reaction).

Scars.

One scar	Two scars	Three scars	Four scars	
T.	T.	T.	T.	T.
T.	V.	T.	T.	T.
T.	T.	T.	V.	T.
T.	T.	V.	I. R.	V.
T.	T.	T.	T.	T.
T.	I. R.	I. R.	T.	T.
V.	T.	T.	T.	V.
T.	T.	I. R.	V.	T.
	V.	T.	T.	I. R.
	T.	T.	T.	T.
	V.	V.	T.	V.
	V.	T.	T.	T.
	T.	V.	T.	V.
		T.	T.	T.
			V.	V.
			T.	T.
			T.	T.
			T.	V.
			V.	T.
			V.	T.
			V.	T.
			V.	V.
			V.	T.
			T.	
Number of cases, 8 Average percentage T., 87 per cent V., 12 ,, ,, I. R., 0 ,, ,,	Number of cases 13 Average percentage T., 61 per cent V., 30 ,, ,, I. R., 8 ,, ,,	Number of cases 14 Average percentage T., 64 per cent V., 21 ,, ,, I. R., 14 ,, ,,	Number of cases 47 Average percentage T., 64 per cent V., 32 ,, ,, I. R., 4 ,, ,,	

If, however, as in Table X, we analyse the cases with four scars into groups of varying scar areas, we find that cases with between 500 and 1,000 square millimetres of scar area have only thirty-seven per cent of I.R. + V., whereas those with over 2,000 square millimetres have fifty-five per cent of I.R. + V.

Table XI shows the constancy of the immune reaction in cases with different scar areas who have been recently vaccinated or revaccinated.

In this group there were only two T., both of whom have been vaccinated in infancy and one of whom was revaccinated in 1920 and the other in 1923, and one V. who was vaccinated in 1918. Apart from these exceptions all the cases in Group III gave an immune reaction, i.e., reached a maximum reaction on or before the third day after revaccination.

In Dr. J. P. Leake's paper, "The Vaccination Scar as an Index of Immunity," the conclusion reached is that "the size of the scar of previous

TABLE X.

Group II.—Ages 18-21.

(Cases vaccinated in infancy and not revaccinated until the present date, November to December, 1926.)

Analysed so as to show in primary vaccinations with four scars the relationship between total scar area of primary vaccinations and the result of revaccination.

The readings are based on the work of J. P. Leake, U.S.A. Public Health Service.

T. = Maximum area of reaction on the 8th to 10th day (Vaccinia).
V. = ,, ,, ,, ,, 4th to 7th ,, (Vaccinoid).
I.R. = ,, ,, ,, ,, 1st to 3rd ,, (Immunity reaction).

Area. (Four Scars of Primary Vaccination in all Cases).

Under 500 sq. mm.	500-1,000 sq. mm.	1,000-2,000 sq. mm.		Over 2,000 sq. mm.
T.	T.	T.	T.	T.
	T.	T.	T.	V.
	T.	T.	T.	I.R.
	I.R.	T.	V.	T.
	T.	V.	T.	V.
	V.	T.	T.	V.
	V.	T.	V.	T.
	T.	V.	V.	V.
		T.	T.	T.
		T.	V.	
		T.	T.	
		V.	V.	
		V.	T.	
		V.	T.	
		T.	T.	
Number of cases, 1 Average percentage T., 100 per cent V., 0 ,, I.R., 0 ,,	Number of cases, 8 Average percentage T., 62 per cent V., 25 ,, I.R., 12 ,,	Number of cases, 30 Average percentage T., 66 per cent V., 33 ,, I.R., 0 ,,		Number of cases, 9 Average percentage T., 44 per cent V., 44 ,, I.R., 11 ,,

vaccination has no practical bearing on a person's immunity against vaccinia or variola." The figures given by me above suggest that even at the age of 18 to 21 years, the immunity remaining from infantile vaccination varies with area of scar produced. Dr. Leake does not state the dates of the previous vaccination or revaccination in his cases. The very high proportion of immune reactions (54 per cent to 76·4 per cent) suggests that a large proportion of the students examined by him had been recently vaccinated or revaccinated. In the figures obtained by me in men presumably of about the age of those examined by

Dr. Leake, the immune reaction was only obtained in from 5 per cent to 10 per cent of those not revaccinated since infancy. The time that has elapsed since the last vaccination in an individual case is, I think, admittedly a very great factor in the determination of the amount of residual immunity in an individual—probably a greater factor than the amount of scar tissue produced at the primary vaccination—and it appears therefore, to be essential for the comparison of immunity remaining from scar areas of varying sizes, that the time factor be eliminated as far as possible. The only cases strictly comparable are those in one age group

TABLE XI.

Group III.—Ages 18-21.

(Cases vaccinated in infancy and revaccinated prior to November, 1926, or with Primary Vaccination performed at a later date than infancy.)

Analysed so as to show the relationship between the total scar area of Primary Vaccination and the Results of Revaccination. The readings are based on the work of J. P. Leake, U.S.A. Public Health Service.

T. = Max. area of reaction on the 8th to 10th day (Vaccinia).
V. = ,, ,, ,, 4th to 7th ,, (Vaccinoid).
I.R. = ,, ,, ,, 1st to 3rd ,, (Immunity reaction).

Areas.

Under 500 sq. mm.	500-1,000 sq. mm.	1,000-2,000 sq. mm.	Over 2,000 sq. mm
I.R. T.	I.R. I.R. I.R I.R. I.R. I.R. I.R.	I.R. I.R. I.R. I.R. I.R. T. V.	I.R. I.R. I.R. I.R.
Number of cases, 2 Average percentage T., 50 per cent V., 0 ,, I.R., 50 ,,	Number of cases, 7 Average percentage T., 0 per cent V., 0 ,, I.R., 100 ,,	Number of cases, 7 Average percentage T., 14 per cent V., 14 ,, I.R., 71 ,,	Number of cases, 4 Average percentage T., 0 per cent V., 0 ,, I.R., 100 ,,

who have been vaccinated only once, and at a known number of years prior to the test revaccination. In my own cases the conclusions are based only on men vaccinated in infancy and not revaccinated until the test vaccination done eighteen to twenty-one years later. All cases that may possibly have been revaccinated, or might have had mild small-pox have been excluded. It appears to me possible that Dr. Leake was unable to correlate the effect of scar area with the result of revaccination owing to the fact that his cases varied in the time that had elapsed since previous vaccination or revaccination. It is likely that men of the student class would as a group show more cases of revaccination than the type of man joining the ranks of the Royal Artillery. Moreover, in America, the custom of vaccination of children at school age is very much more prevalent than is the

case in this country. I suggest, therefore, that Dr. Leake was dealing with cases in which the time factor had not been excluded, and that this factor is likely to interfere seriously with the conclusions that can be drawn from his figures with reference to the importance of scar area.

In an article by Dr. S. B. Grubbs, in the U.S.A. Public Health Reports, Vol. xxxviii, September 21, 1923, reference is made to the value of the immunity reaction as an index of immunity, but the question of its relationship to previous vaccination is not discussed in detail.

In the U.S.A. Public Health Reports, Vol. xli, No. 2, dated January 8, 1926, there occurs a report by S. Thomas of Lehigh University, in which he describes investigations with reference to immunity reactions carried out on students entering Lehigh University. After discussing vaccination generally, and the testing of samples of lymph for potency, Dr. Thomas gives two tables, one showing the relationship of vaccination to time elapsed since last successful vaccination, and the other showing the reaction to degree or character of scars of former vaccinations. The question of scar area in its relationship to immunity, as shown by the effect of varying scar areas of known age on immunity to revaccination, is not dealt with. From the first table Thomas concludes that there is a gradual loss of immunity as demonstrated by an increase in the number of vaccinias and vaccinoids and a decrease in the number of immunes and that this loss is proportionate to the time elapsing since last vaccination. For the purposes of compiling the second table the scars are only roughly classified as "good scar" or "fair scar"—there are no measurements of the scars, nor is any reference made to the time that has elapsed since such scars were made. Thomas bases his statement that "the character or apparent degree of trauma," of the original vaccination scars "are valueless" apparently on the results shown in these two tables.

As mentioned above in this report Dr. Leake in his paper does not state whether or not the cases discussed had all been vaccinated once only before and whether or not vaccination had been done at the same time before revaccination in all his cases.

It appears therefore that no definite evidence as to the relationship between scar area and immunity can be fairly drawn from the work of Thomas or Leake, as by their own showing the time factor is of very considerable importance and yet has not been excluded. If this factor is variable in a group of cases, and if, in addition, many of the cases have been vaccinated more than once, broad conclusions as to the effect of scar tissue cannot be reached. As far as I have been able to ascertain, no conclusive piece of work showing that the scar area has no relationship to the immunity produced has yet been published. On the contrary, the experience in outbreaks of small-pox in London, Liverpool and elsewhere has shown a relationship between scar area or the number of insertions and mortality rates from small-pox, a fact which the work described in this report appears to bear out.

SUMMARY.

The present report is a summary of the preliminary work carried out at the Royal Artillery Depot at Woolwich. The investigation was carried out amongst recruits of 18 to 21 years of age.

Details of the classification of the cases, the technique employed, the method of taking measurements, and the means by which the figures given in this report were obtained, are dealt with.

The possible fallacies in the observations are then discussed, viz., previous vaccination or revaccinations which the patient denied, cases who have suffered from unrecognized mild small-pox, immunity obtained through cowpox, the difficulties in obtaining larger numbers for measurement, and the difficulties in obtaining accurate measurements.

The report then describes the rashes that were occurring in nearly 74 per cent of the cases after vaccination and, after showing the effect of these on the production of severe reaction, states that with the change of dressing, such rashes have now ceased to occur.

The effects of single line scarification, as compared with multiple scarifications, are contrasted, and the complete absence of hospital admissions for severe vaccinia since the adoption of single line scarification is noted.

Observations as to the effect of drill on the severity of reaction are recorded, and the conclusion is drawn from the work at Woolwich, and independently at Caterham, that the routine excuse of men from duty is followed by more cases of severe reaction than when such men continue to perform duty.

The report then deals with the amount of immunity remaining in men of 18 to 21 after vaccination in infancy, the relation between scar area of primary vaccination and immunity, and the relation between the number of lymph insertions of primary vaccination and immunity.

It is noted that the effect of primary vaccination in infancy is to accelerate the day of maximum reaction to vaccination in men 18 to 21 years old by over three days and it is suggested that this represents the average amount of immunity remaining at this age-group from infantile vaccination. Subsequently it is shown in a series of observations that the amount of acceleration on the day of maximum reaction varies with the amount of scar area produced at the time of primary infantile vaccination.

The report concludes with a note on the work of Thomas and Leake in America and the possible reasons why their investigations failed to show a relationship between scar area and resulting immunity.

THE CANTONMENT ANTIMALARIA PROBLEM.

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This is a problem we all appear to be faced with sooner or later, generally sooner, and these random notes are only put forward tentatively, with a view to getting others with greater experience to continue the discussion.

There are many points in this very difficult problem which can well bear discussion, and many of us who are engaged on this work will surely be only too pleased to hear personal views on those raised.

The following remarks are by no means intended to be exhaustive, nor are the opinions expressed in any way authoritative; but the points have been brought up at random with the object of obtaining other opinions on them.

Recently at the malaria section of the meeting of the Far Eastern Association of Tropical Medicine, it became obvious that there was a considerable diversity of opinion as to the best methods of tackling this huge problem; and each party (the dry and the wets) did its best to convince the others; and each appeared to remain convinced that its own pet methods were the best for the general problem. The truth presumably is, as has been stated by many eminent malariologists, that one method will not suit all localities, and that each locality requires a combination of two or three of the best-suited methods.

(1) The Shape of our Localities.

The localities with which we have to deal are usually as badly situated and shaped as they could possibly be. Are we to attempt complete anti-mosquito methods (including antilarval) in a cantonment the border lines of which resemble the sections of a jigsaw puzzle? We may, if our methods are sufficiently skilful, eliminate every mosquito and every larva from an area of say 800 yards square, and yet 100 yards or even 50 yards from an inhabited barrack or married quarter in that area is another which is completely out of our control, which is covered by a civil village with the choicest of breeding places and a sixty per cent spleen-rate amongst the population, and which we know is the latent source of infection with malaria and other things. Is there any "plains" cantonment in which just such a condition as the above does not exist?

Or, again, in the best regulated cantonment, do we not all know of the private compound, occupied or not, tenanted by an ignorant officer, a C.M.A.'s clerk, or an Eurasian shopkeeper, which had one or two breeding places and which were constantly found to be producing *A. stephensi*? Many

of our cantonments have a fine parade maidan, usually flat; in fact so flat that during the monsoon it is a shallow lake of two to three inches deep for weeks at a time, the potential breeding place for *A. culicifacies*. Presumably therefore, we may consider our locality an extremely difficult one. Are we to continue our yearly efforts at antimosquito and antilarval work with any real hope of getting sufficient results for our expenditure of time and money; or are there better methods to employ?

(2) THE FORMATION OF BREEDING PLACES.

The borrow pit and the buffalo wallow. What are we to do about these in our cantonment? Orders are issued and rules are passed that no borrow pits shall be made in cantonments; and yet we find borrow pits being made on every side of us. Our friends of the engineering services are without doubt the greatest culprits; and it appears to take an enormous amount of repeated persuasion to impress on them the reason why we object to the formation of borrow pits. Even if the engineer service itself does its best to prevent the practice, the local contractor cares not a jot, and proceeds to dig holes to his heart's content all over the cantonment, or, if the rules are strictly enforced, he retires fifty yards away and continues his pastime outside the edge of the cantonments. Are we not provided with a network of borrow pits over the whole continent of India by those industrious engineers of the railways? And one chain of pits probably passes right through our cantonment.

Units of various persuasions, pioneer, infantry, cavalry, under gentle pressure from brigade commanders, set out to improve the situation by laying out series of practice and assault trenches, and immediately a number of breeding pits are established which are difficult to cope with; and the trouble is the procedure has probably been completed before any information reaches the antimalaria officer.

The grass farms and cantonment boards make much profit from grazing in and around cantonments. The grazing animals include buffaloes which cannot flourish without water, and these buffaloes proceed to make the necessary water places by wallowing in any suitable puddle, with the result that chains of shallow wallows exist all over cantonments and new ones are constantly being made. What are we to do to cope with these? In the passing of orders and rules as to digging and grazing we have certain remedies, but are we to continue with our antibreeding methods of prevention?

(3) IGNORANCE.

Here we have a factor which we are all up against. Ignorance is present in the very midst of our own military populations; but it is, we believe, being slowly overcome by repeated lectures and demonstrations, by malaria films and practical classes. But what amazing examples of ignorance we encounter. We met not very long ago a senior engineer officer in whose

hands was the spending of some Rs. 10,000 on M.E.S. antimalaria work, and yet he was completely ignorant of the elementary fact that mosquito life history includes an under-water period.

A senior warrant officer's family, with two children down with malaria and the father a chronic malarial case, are found with a copious breeding place of anopheline vectors within twenty yards of the bedroom, and the parents are surprised when informed of the danger and shown the larvæ. Or, again, the wife of the second in command of an Indian infantry battalion who complains of a bedroom filled with mosquitoes, and who is yet astonished at being shown some millions of mosquitoes breeding in the bathroom sump beneath her bedroom window.

Yet these are all just the type of personnel who escape instruction because they never attend antimalaria lectures, demonstrations or films. What can we do with the education of such folk? But even more. What of the colossal ignorance and complete indifference of the mass population of our Saddar and other bazaars? Can we hope to educate these, or are we likely to succeed in producing any effect from such lines of antimalaria work? With our own military population we hope in time that such crass ignorance will become gradually less, but we cannot expect to achieve much with the bazaar folk.

(4) The Use and Abuse of Oils.

In our Indian cantonments oil is an issue not bought from station antimalaria funds, and we see the enthusiastic antimalaria squad joyfully proceed to sprinkle oil on every available spot of water, irrespective of whether each spot of water has been shown to be a breeding place of anophelines or not. The result is that such ponds and streams as are in cantonments all usually show signs of this energetic oiling, whereas obvious breeding places within a stone's throw of the cantonment boundary are untouched. Are we wasting our efforts and our oil, or do we really achieve a good result?

The distinction between culicine and anopheline is too much for the average lay mind in cantonments, and the antimalaria squad is only considered to be successful when it annihilates all types of mosquito larvæ. Therefore, for the present, with our population such as it is, it would appear that this blunderbuss method of attack is probably the most satisfactory and may be allowed to continue.

(5) The Use of "Filling."

Day by day we see cartloads of rubbish carried away for burning or for the purpose of breeding flies on the surrounding grass farm lands, and yet in cantonments there are old borrow pits, swampy areas and unornamental ponds, etc., which are calling out to be filled. Surely, here we have a line of attack which can be used with profit; a method which, if a systematic

programme be arranged, will in a few years' time produce a very definite result and give us our cantonment freed from numerous pits, ponds and swamps.

(6) Mosquito Surveys.

Constantly we are urged to carry out anopheline carrier surveys of our cantonments; particularly with a view to directing our attack only against the known carrier or carriers. This would probably form eventually one of the most profitable and economical lines of attack. The method, however, requires a fixity of purpose, an adequate knowledge and, above all, a security of tenure (for at least one year) of the "appointment" on the part of the antimalaria officer.

It can hardly be accomplished by an "antimalaria officer" who proceeds to camp for six weeks; marches with a unit which is changing station for three weeks; takes over two sick parades, the venereal wards and staff surgeon, in addition to his other duties; or who, in the very middle of the malaria season, is transferred urgently to another station.

The entomologist who is capable of making a proper mosquito survey is a very specialized person, with a mind trained to minutiæ of detail, and the military antimalaria officer is, perforce, distinctly a jack of all trades in comparison with him and may well lack the necessary detailed knowledge. However, in spite of all this, knowledge on this subject is gradually accumulating, and work on this branch of science should make our methods for dealing with the problem easier and more economical year by year.

(7) The Use of Spot Maps.

This is a method which is a great help and costs practically nothing more than a few minutes' trouble daily. It is not the spot map of the station showing anopheline breeding-places which is referred to, though that undoubtedly has its uses, but the spot map of the unit which is the one which proves so valuable.

If a large-scale map or diagram of the unit barracks is maintained in the M.I. room or, better still, in the orderly room, and if on this is noted the bed position of each man who is admitted to hospital with certain diseases, then information is readily obtained if a collection of spot marks in one barrack room, or in part of a room, indicates that a focus of infection is occurring there and requires early action.

This method is of use for many diseases besides malaria, and is without doubt very valuable. Ought we not to try to insist on the use of such a map by every unit in our cantonment?

(8) Fumigation.

Are we to use this method or not? Is the expenditure of time and money going to give sufficient results? The method has been widely praised and strongly advocated for barrack use. The wonders of the method have been extolled by the experts.

It is true that *if* the rooms can be sealed, fumigation is completely effective; but our experience has been far from encouraging. Barrack rooms are not easy things to seal, and Indian barracks are practically impossible. A series of rooms were sealed as well as possible and heavily fumigated with varying strengths of sulphur. The result was: (1) A varied bag inside; (2) an assortment of perfectly happy mosquitoes from corners and cupboards; (3) a beautiful blue halo over the whole roof, where the fumes were pouring out through the tiles, much to the annoyance of all the local crows and sparrows.

So we came to the conclusion that for the average barrack room the method was not worth the expense and labour. Will others with greater experience enlighten us on the secrets of their success?

(9) Spraying.

In this we may claim to have an efficient, and it may be a cheap method of attack on the mosquito. It is a method which appeals to the popular fancy, particularly if that populace has the pleasure of actually being able to buy its own materials. The materials personally purchased are naturally always more effective than those supplied or available free of cost. However, apart from this consideration, it is really a method which has proved very effective during the past season.

There is one proprietary spraying solution which is undoubtedly effective, and has been extensively used by the more wealthy units and individuals. But there being no reason why we should help to swell the already sufficient numbers of American millionaires, we tested a variety of substitute solutions. The formulæ of those which were found to be most effective were circulated for publication in all station orders, and have been used with success in a number of places. The best two solutions were:—

(*a*) Paraffin, 2nd or 3rd quality	.. 65 per cent		
Petrol, cheapest	32½ ,,	..	Approximate cost, Rs. 2/12 per gallon
Oil of citronella	2½ ,,		
(*b*) Paraffin, 2nd or 3rd quality	.. 70 ,,		
Petrol, cheapest	20 ,,	..	Approximate cost, Rs. 3/4 ,,
Formalin	5 ,,		Requires shaking
Oil of wintergreen	5 ,,		

There were strong criticisms on the effectiveness of these in certain stations, and it is hoped that this especially may be one of the points on which correspondence and discussion will give us further knowledge. If we can produce effective spraying solutions, is not this the method of choice rather than the method of fumigation?

(10) The Soapy Hand Method.

This is a novel method employed with success in a number of stations in this district, and others may be glad to learn of a new method which is cheap yet effective: (*a*) One man carries round a bowl of strong soap

solution and a stick; (*b*) another man repeatedly lathers his hands. The stick is rattled against equipment, boots, hangings and in dark corners, and causes the mosquitoes to fly out. The soapy-handed gentleman then gently pats his hands at the mosquitoes, and any that touch the soap at once collapse into it.

The record "bag" is about 430 from one company's barrack rooms in one morning. Bags this year have only averaged about twenty-nine to thirty.

The method undoubtedly has had considerable effect, and can be carried out as a morning routine by the barrack-room orderlies.

(11) Personal Protection.

Mass Protection.—Recently we have seen an able article in the Journal expounding the results of such mass protection in the Lahore area, and we ourselves have been watching the effects of such protection at Delhi Fort. But elsewhere, particularly in the States, the value of mass protection by house screening has been amply demonstrated, and house screening is now regarded as an essential feature of tropical life.

Surely we in India have got beyond the experimental stage in mass protection? Surely we have now reached a stage where mass protection by proofed barracks should be regarded as an essential practice to be employed, as soon as funds are available, for all barracks in our cantonments?

Surely our methods of building should now automatically include mosquito proofing for all new buildings, whether barracks or quarters, which are intended for actual living rooms?

Should not the standard patterns of such buildings be so altered that full mosquito proofing can be included at a minimum of cost?

We have recently seen in the Journal an article and a note on the subject of the present type of building which the M.E.S. regards as a tropical building. Would not mosquito proofing do something towards rendering these extremely untropical buildings more suitable for the country and climate?

Since the results obtained from mass protection have been so good where it has been carried out, should not we, for the sake of our cantonment, concentrate more on attaining such a method of protection rather than carry on year after year with the same old routine of antilarval methods in a confined area surrounded by uncontrolled breeding grounds?

This, again, should be a suitable point for discussion in correspondence.

Individual Protection.—This method has probably done more for the real diminution of the malaria incidence than any other single method. But how often do we see it fail, and how can we lessen the numbers of times on which it does fail? Only the strictest unit discipline will ensure proper use of the individual protection during a hot week of a break in the

rains, or nights of mid-September. But the failure is not usually in the unit barrack room, but in the "odd job" man, the man who has his own bunk, or is on a detached job or a special duty. How can we deal with this type of man? Presumably only by educating every individual of every station up to the required ideal. But what example do we ourselves set in this respect?

What is the antimalaria officer of a station to do or say to troops, when it is known that senior medical officers are in the habit of sleeping out in full view with no net?

Or again, when he finds that a whole portion of a unit has been without net protection for six weeks, because the medical officer in charge of the unit had said something about nets being unnecessary in June, although a stream known to be an anopheline breeding ground flowed close past those lines?

Another reason why this method fails is that, the net being the man's own property, there is no reserve in the unit. The net is sent to the dhobie by the company officer's orders, the dhobie fails to return the net in time, and the man sleeps the night without.

Or, again, we find protection fails lamentably on a journey, particularly that dangerous journey to or from the hill station for the mid-season reliefs.

What can we do to ensure continued protection during these periods of danger?

(12) A Summary.

In the above random jottings we have mentioned briefly a variety of points which arise naturally in the mind when considering antimalaria work. It is realized that there are many points which have not been mentioned. But if only these notes produce discussion and correspondence from others much more competent to deal with the subject than the writer, then indeed they will have achieved their object, and we shall gain in our knowledge of how to deal with the antimalaria problem of our cantonments.

THE WATER SUPPLY OF A DIVISION UNDER ACTIVE SERVICE CONDITIONS IN EGYPT.

By Captain G. K. FULTON.
Royal Army Medical Corps.

The following account deals with the water supply of the British troops in Egypt during Command Manœuvres, 1927.

The only water available was from irrigation canals on the east side of the Nile. Water from these canals is grossly polluted, the banks being used as a public latrine. The canals are also often used for the disposal of carcases, and lastly, the danger to the troops of infection with schistosomiasis must be constantly borne in mind.

Three water points were erected on the El Hagir canal. They were roughly eight miles apart, and supplied two different types of water: (1) "A" type; water which was sedimented, filtered, and chlorinated on the spot, and issued ready for use; (2) "B" type; water sedimented only, and requiring filtration and chlorination, in unit water carts. Owing to the gross contamination of the source it was considered that both sedimentation and filtration were necessary before chlorination.

The general lay-out of each water point was essentially the same. The crude water was pumped from the canal to sedimentation tanks by hand lift-and-force pumps, the rose at the intake being anchored by means of pickets, as near the centre of the canal as possible. The sedimentation tanks were of galvanized iron, of various shapes and sizes, some cylindrical, others rectangular, and of a capacity from one hundred to four hundred gallons. To get the best results, it was decided that the outlet from the tank should be about one foot six inches from the bottom. In some of the tanks the actual outlet was at this distance, in others the same result was achieved by means of a right-angle pipe carried up the inside of the tank. It was found that this latter type was bad, as the deposit settles in the upturned arm, and comes away with the first rush of water on opening the tap.

Crude alum sulphate, from the local waterworks, was used. This was only obtainable in large hard pieces, which had to be broken down into small pieces with hammers, and was then found to go easily into solution. Time did not allow of accurate experiments being done regarding the best amount to be added, but six grains per gallon gave good results, and this amount was adhered to throughout. The alum was made up into solution of such strength that one pint added to each hundred gallons of water gave six grains per gallon. The solution was added at intervals during filling, and the water allowed to stand for eight hours.

The result of this sedimentation was a clear water, in marked contrast to the muddy water of the canal.

To the outlet from each sedimentation tank a length of hose was attached. This hose was lettered with similar letters at both ends, so that no matter where the hose was led, one could tell at a glance from which tank the supply was coming, and check the clarity of the water from that particular tank. The sedimented water was run to large canvas storage tanks by gravity.

From these storage tanks, water could be distributed to two points. Firstly, by lift-and-force pumps to storage tanks for "B" type water, this now being ready for filtration and chlorination in unit water carts; and secondly, taken for use in preparing "A" type water.

For "A" type water filtration was effected through the filters of three stationary regimental water carts attached to each water point. The outlet pipes from the filters were disconnected from the tanks of the water carts, and taken, by means of an extra length of hose, to "A" type storage tanks. As each tank was filled, Horrocks's test was applied, the capacity of the tank determined, the requisite amount of bleaching powder added and well stirred in. It is recognized that a drip feed for bleach solution would probably have been more efficient, but time did not allow of its improvisation.

The supply to the troops from this point was by means of fanatties. These held approximately twelve gallons each, and were filled by lift-and-force pump. They were carried to the troops by camels, two constituting a load. A stock of fanatties was kept at each water point, so that camels coming in unloaded their empties, picked up full ones which were ready for them, and moved straight out again, thus avoiding waste of time and disorganization at the water point. The empty fanatties were filled at leisure, before the arrival of the next camel train.

As regards the supply of "B" type water, unit water carts were worked by unit water duty men, under the supervision of trained personnel of the R.A.M.C. Directing notices were erected at the storage tanks, carts being allowed past the tanks in one direction only. After filling and chlorinating, carts were parked for half an hour in order to insure the necessary contact time. This worked well, but many lessons were to be learned regarding the carts themselves. All water duty personnel should know something about the mechanism of their carts, so that minor repairs can be carried out on the spot; carts should be sent out fully equipped to scale, extra cloths are always needed, as they shrink and become torn with constant use; washers, etc., wear out and need replacement. Finally, all carts should be periodically tested "under pressure," i.e., with reels and cloths in position, it being only by this test that the general condition of the cart can be ascertained, the efficiency of the pumps determined, and leaks discovered and rectified. It is quite worth while to get the water duty personnel to realize that the better the condition of their cart the less work at the pumps they will have to do.

All tanks, with the exception of the sedimentation tanks, were of the

canvas variety. These were let into the ground. Care is required in their erection to avoid the weight of water splitting the sides. In practice it was found that with careful packing of the sides with sand and sandbags, little trouble was experienced. This is a most important detail as, with storage capacity at a premium, one cannot afford to have it reduced. The capacity of each tank was 1,500 gallons.

The danger from schistosomiasis was very considerable, as the irrigation canals harbour the intermediate host, and the native population is heavily infected with the disease. The only precaution taken was storage. Careful records were maintained, and no water of either type issued which had not had previous storage for at least forty-eight hours. In addition, a fine rose was fitted to all crude water intakes, to prevent the possible access of snails to the sedimentation tanks.

Regarding results, the whole scheme worked to perfection, no hitches occurred, the troops received an ample supply of water, and there was no complaint of shortage. More water was available at each water point than was ever asked for.

The troops were actually supplied with water for six days. Before operations commenced, a table was issued by the staff giving the approximate amount of water which, it was estimated, would be required at each water point. This was subdivided into daily requirements. The highest estimated daily requirements were at the most central water point. Here the estimate was 3,500 gallons "A" type and 3,200 gallons "B" type daily for three days. Fifty per cent. was added to allow for leakage and unforeseen circumstances. No difficulty was experienced in meeting these requirements; in fact, once the water points were established supplies could have been kept up indefinitely. The only difficulty which might have arisen was storage. This would have been helped by the empty fanatties held at each water point, giving additional storage for approximately 2,500 gallons at each place.

As regards chlorination. The average amount of bleaching powder required was one and a half to two scoops per hundred gallons. As the average chlorine content of the bleaching powder was only 10·5 per cent., this would appear to be a most satisfactory result. Only one complaint was received of chlorine taste in "A" type water. This was investigated, and it was found that the water complained of had not been issued from a water point, but had been brought out from the base. With "B" type water the story differs. It was quite evident that the chlorine taste does not disappear after half an hour. It appeared to be impossible to arrange for carts to remain full all night. After a day's work in the desert, carts arrive empty, move direct to a water point, fill, chlorinate, and the water is immediately required. However, with careful staff work on the part of the unit, it should not be difficult to ensure that only one cart is used at a time, thus allowing the other to stand as long as possible.

Another point worthy of note is in connexion with the water supply

to the N.A.A.F.I. Mobile canteens are attached to each unit, and in theory should draw water from the water carts of that unit. In practice it is found that water duty personnel who, after a hard day in the desert, have filled a cart with much labour, are most loath to give water to a N.A.A.F.I. employee, especially if he happens to be a native. The travelling canteen was always a great source of worry to the water point personnel. Natives arrived in numbers with all manner of receptacles for water. When operations first commenced, it was uncertain how much water would be required, so that indiscriminate issues could not be made. These natives were referred back to their units, who in all probability refused them. Many were the instances when natives were caught by the water duty police taking crude canal water back to the canteen. When it was realized that the water was adequate, and would meet all requirements, arrangements were made to supply canteens direct from water points. It is obvious that, in future, the method of supply to travelling canteens must be laid down beforehand.

Some little difficulty was expected in getting full carts through the soft sand at the water points. To obviate this extra mules were stationed at each water point, but in practice they were rarely used, as units had foreseen this difficulty and equipped their carts with two pairs of mules instead of one.

Conclusions.

It will be seen that, with ordinary R.E. stores, plus alum and bleaching powder, it is possible to produce a safe drinking water in any part of this command which is fed by irrigation canals.

The erection of each water point requires a considerable amount of labour, the transport of stores is large, but the point is stationary when once erected. In the event of active service operations, water would have to be carried long distances over trackless desert, and it is considered that a water lorry, on similar lines to the present lorry but lighter in weight and mounted on a chassis with six wheels or caterpillar track attachment, could be designed to surmount these difficulties. Schistosomiasis could also be dealt with, in this case, by massive doses of chlorine, followed by dechlorination with sulphur dioxide. This unit would be mobile, could move to the canal or well nearest the scene of the operations, and supply pure water direct to the troops, either by fanattie or water tank.

It may be mentioned that no case of disease has been recorded which could have been attributed to this water supply.

Finally, tribute must be paid to all ranks of the 42nd Field Company Royal Engineers, to whose work the success of the scheme may be attributed. My thanks are due to Lieutenant-Colonel R. B. Ainsworth, D.S.O., O.B.E., R.A.M.C., for much advice and kindly criticism, and to Colonel H. C. R. Hime, D.S.O., D.D.M.S. British Troops in Egypt, for permission to publish these notes.

EGBERT.

By U. P. A.

Dearest Georgina,—There is no need for me to post this letter. You sit facing me on the opposite side of the hearth; indeed, our toes are touching on a common hassock; but—write I must, for this is a subject on which I dare not trust myself to speak. Take this letter, therefore, and read it. Talk about it if you like—but not to me, nor in my presence, please. File it in the family's archives for record and, if necessary, for reference; it treats of a never-to-be-forgotten experience which, if recounted in the future, must be told with due exactitude, pathos and pride.

It all began with No. 3509—the issue dated April 7.

I beg of you, Georgina, never look at that journal again. Be warned by my case. I know that your only interest is in the back pages: "Death vacancy, Wigan. Sound old-established practice over £3,500 p.a. Panel 100. No midwifery. Fees 2 to 5 guineas. Premium £1,000. Great scope."

Be warned by my case.

As you know, the back pages do not attract me—not since my promotion to the exalted rank of Major; a stepping-stone. . . . So, on the arrival of No. 3509, I turned to a symposium on "The Ætiology of Alcoholism," and this is what I read:—

> " . . . Three main ætiological factors . . . namely, the partial fixation of the libido at certain levels, the constant tendency to regress to a narcissistic ego-organism which automatically set primitive mechanisms into action, and disorders of primitive conscience, which led to fruitless exploitation of this mechanism of projection."

Did this confound me?

Alas, no! for on that day I was overcharged with self-assurance.

Did it scare me off?

Alas, it did not! on that fatal day my *moral* was proof against the most libidinous narcissistic No. 3509 was capable of featuring.

Then—what effect did this broadside produce?

Be warned by my case, dearest Georgina—it whetted my curiosity; that was all; and yet, what a very great deal it turned out to be in the end.

Idly, I turned over the pages of No. 3509.

Georgina—have you ever suffered from thrombosis of the posterior tibial venæ comites? or from arthritis of the left knee with a "flare-up"? or from osteitis deformans? Have you ever been attacked by tenosynovitis of the wrist, sciatica, dyspepsia or anæmia? Are you a martyr to myocarditis, emphysema, or to pain and swelling in the right hand?

In other words, do you possess a tooth which has died before or after filling ?

No ?

Well, I do ; or, to be more exact, I did—for Egbert was rudely filched from me yestereen, and his flitting has left a dull and aching void.

Do not be alarmed. There is no greater bore than the wretched fellow who chips in with : "I don't agree. When *I* was at Bailleul—" or Boulogne, Basra, or Bethune, or wherever the wretched fellow happened to be. But he is closely rivalled by the miserable man who interrupts with : "Oh ! but when I went to Tugger he had six rockings, seven pulls and eight wrenches before he got the thing out. I felt like, etc." Most miserable man.

I know all that.

That is why I do not propose to speak to you of the departed Egbert.

That is why I do not intend to tell you about that last, poignant farewell.

I would not harrow you with gesture, intonation, and reconstruction of the crime.

No.

That is why I put it down in writing, now.

For, dearest Georgina, you have a soft heart. You are full of sympathy and understanding. You could not bear to think of me labouring under suppression, repression and depression for the remainder of our united lives. So let me hasten to set down in coal-black lettering the painful story of Egbert The Innocent—and be done with it.

If ever I revert to this terrible tale, silence me, I pray you.

Egbert is—was—a faithful friend and industrious servant through countless vicissitudes, and for more years than either he, or I, care—cared—to remember. We had our ups and downs in life. Often these have coincided ; have, in fact, been interdependent. Now and again, and especially after a particularly heavy spell of work, Egbert would complain of his quarters—posterior third, lower maxilla, r. On such occasions I used to take Egbert along to the nearest dental surgeon for palliative treatment.

That was always a disagreeable business. Not that my dental friends ever objected to treating old Egbert ; no, they were always ready and willing to treat him—but not palliatively. And the worst of it was that, whether Egbert was in the picture or not, those radically-minded dentists always made a dead set against the poor chap. No matter whether the consultation concerned an incisor, a canine, or an upper molar l., Egbert (post. third inf. maxilla r.) was certain to be dragged in, in the hope of being dragged out.

As a result of my consistent championship, Egbert was grateful, and played up like a pre-war batman ; never let me down, stood by when others

failed, and was never off duty unless genuinely sick. And all this, mark you, despite the most devilish batterings, excavations and super-chargings imaginable. As I say, those dentists hated the sight of the ubiquitous Egbert. They took their revenge on his tenacity by reducing him to a mere vestige of his original self, and filling him with as much metal as would serve to ballast a ten-ton cruising cutter.

Georgina . . . through it all . . . Egbert—and I—stuck together.

Fair weather or foul, we laughed and cried—together.

And now—Egbert is no more.

You see, Egbert must have discovered that discretion is the better part of valour because, for a long time past, he had given up the unequal contest against the armoury of awls, adzes and amalgams. For several years he had done his job quietly and industriously, without protest or complaint.

When, therefore, No. 3509 of April 7 endeavoured to divert my allegiance with its absurd *canard* about the tooth which dies before or after filling, I did not argue the point, I did not weigh up the *pros* and *cons*, I did not even pass the slander by unnoticed. No. I treated the shabby thing with scorn and contempt; I jeered at it.

Pride goeth before a fall.

That very night I sought sleep, but it was denied me.

That very night I felt a premonitory twinge of sciatica and an aura which, I felt sure, presaged an attack of emphysema. I also experienced a number of ill-defined sensations which I referred to my knee, r. (arthritis ?), and wrist, l. (tenosynovitis ?). By daybreak I felt thankful that I knew nothing of the signs and symptoms of the libidinous narcissistic—a nasty-sounding label which I was fain to avoid.

I arose cramped and stiff, with the pallor of anæmia on my cheeks and the appetite of a chronic dyspeptic. And yet, despite my utter demoralization, I bore old Egbert no ill-will. I repeat it: I bore my oldest and best friend no malice; but—it was an evil hour nevertheless. . . .

"The usual routine visit, Mac. Just have a look round and see that everything is shipshape and in order."

(Business.)

"H'm. Is your general health quite good ?"

"Excellent, thank you."

"Let's have another look."

(Business. The Macrimmon hits Egbert with a hammer, jabs a neighbouring molar with a sharp-pointed steel pole, and rocks three incisors until they are loosened in their sockets. Still, on the whole, I come through it fairly well.)

"H'm. What like d'ye say is the general health ?"

"Excellent, thank you."

"Well, if you'll have the lot out, you'll feel better still. Awful state of

affairs. And as for this one"—here he re-hammered Egbert—"a sink of iniquity, a quiescent volcano which may destroy you in a moment, an assassin lurking——"

It was too much. I bit The Macrimmon's finger—Egbert did it.

That is the worst of the Scot; devastatingly outspoken, no regard for delicacy, unutterably downright, no notion of *les convenances*. Why on earth the A.D.C. enlists him at all I never can understand.

Dissatisfied and distressed, I entered the establishment of Messrs. Brown and Robinson.

Robinson was the junior partner. He had just returned from a post-graduate course in New York.

"No—nothing amiss; just the usual periodical inspection."

(Business.)

"You sure are streakin' for the crematory, sir."

"I—don't quite—what do you say?"

"Just this, major; you want ter get rid of the whole caboodle, quick, else you'll be buying your plate in a place where gold is cheap'n it is here. General health all to pieces, I reckon."

"No, it is not. It is excellent."

(More business.)

"Wa-al (jab) this (poke) an' this (lever) an' this (prick) an' this (savage assault on Egbert)— "

At this point Egbert closed on Mr. Robinson's finger, and I was conducted next door for an opinion from Mr. Brown.

The latter was big and burly, like a heavy-weight pugilist. Also he was artful; he managed to withdraw his finger just in the nick of time.

It was impossible to think of entrusting Egbert to this brutal, unscrupulous Englishman. It was equally impossible to place his fate in the hands of the materialistic man from New York. Everything, therefore, pointed to The Macrimmon as the arbiter of Egbert's destiny; and could one do better than choose a native of the Isle of Skye—that land of soft, grey cloud and gentle rain, of green headlands and purple heather, of fair-haired fisherfolk and fairies, the home of the pibroch? And what an inspiration—what a chance for The Macrimmon! A new pibroch; the title—"Egbert's Lament"!

Yes, there is no doubt that the A.D.C. has attracted a desirable type of Scot; scientifically sound, professionally capable and uncannily human. Egbert could go farther and fare worse.

Next morning you, Georgina, conveyed me to the place of execution—you remember?

The 12 h.p. tumbril covered the two miles in two seconds—is it not so?

My old friend Bousanquet gassed me. He had been specially selected, as a typical sample of the immigrants of 1066; like William the Conqueror, cold, calculating, long-headed. I felt that, whereas the composition of "Egbert's Lament" demanded Gaelic imagination and artistry, the

administration of gas was a different matter; one which would be better served by Norman phlegm.

Not that Bousanquet had it all his own way—not by any manner of means. In fact I scored off him, and heavily too, for I had an inkling of the plan of campaign; and forewarned is forearmed.

Bousanquet had made up his mind that I should inspire a *minimum* amount of gas.

The Macrimmon had determined that I should be deprived of a *maximum* number of teeth.

We began.

"Breathe easily and naturally," said Bousanquet.

I held my breath, obstinately.

"Breathe, breathe, don't be afraid."

I gulped, swallowed, shifted uneasily and absolutely refused to allow the mechanism of respiration to function. At least, so Bousanquet thought; but, as a matter of fact, I was, all the time, swallowing the stuff by the cubic yard. It was the most successful piece of deception I have ever practised. In a matter of three seconds or so I felt a rush of pins and needles down both arms, the sky became blue, there was a sound of rushing waters, a cool soft breeze blew in my face, and the "Zephyr" flew on the crest of the waves as I headed her, close-hauled, for the Kyles of Bute.

The last I heard of Bousanquet was: "My dear fellow, for heaven's sake breathe! Don't hold out like this or—"

Presently, away, away in the distance, a sound fell on my ears. It took shape thus: "Ship-a-hoy! Finished. It's all over. Finished. It's all over—" repeated many times.

"Finished," was Bousanquet. "It's all over" was The Macrimmon.

I lay back, quiet and still, and enjoyed myself, while my two unhappy attendants shouted, "Finished," and "It's all over," till the rafters rang. However, Bousanquet's voice cracked, and as I could not abide that, I opened my right eye and winked.

Satisfied as to my safety, the precious pair proceeded to entertain me to an impromptu discussion of the case.

"Well—how the devil should *I* know he was drinking it in like that?"

"If *you* didn't know—damme—who should?"

"I'll bet he didn't feel anything at any rate."

"That's not the point; if you had not stopped me I could have removed three, or maybe four, more. Sickening, I call it."

"I like that! Aren't you content with what you've got? Seven at a sitting—"

At the word "seven" I decided to hear no more. A joke is a joke, Georgina, but people never seem to realize that humour should not transgress the rules of good taste. In any case, I had by this time discovered, by means of the tip of my tongue, that Egbert was still with me.

I was satisfied.

On the following morning you again conveyed me to the scaffold.

You agree that, on this occasion, the 12 h.p. tumbril covered the two miles in 1·5 seconds?

Dearest Georgina—that heartless Bousanquet had been turning things over in his mind. There was a cold glint in his eye, a pitiless smile on his lips, a crispness in his actions, a hardness in his voice which—as they say in Hindustan—turned my liver to water.

I saw it was useless to appeal to him, so I turned to The Macrimmon and begged him, for the honour of Caledonia, to behave in a manner worthy of an officer and a gentleman. As an afterthought I added that, in the event of certain contingencies, I should make him rue it for the rest of his life. I regret to record that he was not impressed. He said that dentistry had neither time nor patience to consider hypothetical eventualities.

A pretty state of things! Faced by a couple of desperadoes who, obviously, were out to achieve their unspeakable ends by fair means or foul; cowed by a brace of brigands who, clearly, knew nothing and cared less about such noble maxims as "Never strike a man when he is down," and "No hitting below the belt"—and the grand code, the Briton's code, in which these maxims are enshrined. The situation only too well appreciated; the problem beyond solution.

Georgina—have you ever seen a sparrow hypnotized by two boa constrictors?

No?

Nor have I.

But now I know all about the sparrow.

In a superhuman attempt to defeat Bousanquet, I reversed my former tactics. I lay quite still and inhaled the noxious vapour at racing-stroke speed. At Hammersmith Bridge I cautiously opened one eye. Bousanquet was watching me with the keenness of a hawk, and ordered me to douse my starboard light. He was quite snappy about it. Then twilight fell, and Tannhauser walked wearily on to the stage, sat down under the spreading branches of a great tree, and sang. It was "O! Star of Eve." Divine. Towards the end of the song a curious thing happened: the drummer banged the drum on both sides, trod on the cymbals, knocked the triangle off its hook and shot the conductor. He then vaulted over the orchestra rails, and stabbed me in the right lower jaw with a red-hot harpoon.

To say that I was astonished, and shocked, is to put it quite mildly. Indeed, were I to describe my feelings without making use of a few terminological inexactitudes, I should have to use an asbestos writing paper.

The Macrimmon came to the rescue by offering me a carbolic cocktail; and while I was sampling this delectable beverage, a pre-war, blunt-nosed, ·415 revolver bullet fell out of my mouth and into The Macrimmon's new soda-water fountain. It cracked the glass lining. Bousanquet grinned. The Macrimmon scowled and I, by manipulating the tip of my tongue, discovered an intact, ever-victorious Egbert.

But, Georgina, he was intact in form only; his substance had vanished, as The Macrimmon's cracked soda-water fountain showed. And although still victorious, poor, patient, faithful old Egbert's days were now definitely, irrevocably numbered. Indeed, like Absence without Leave, they were numbered in hours, for although the day was by now far spent (10 a.m.) I was requested to return at 3 p.m.

Egbert was reprieved—for a paltry period of five hours, five twenty-fourths of a day; that was all.

So far I have told you nothing; nothing of any consequence; nothing that counts.

May I repeat this? May I say once again that, so far, I have told you nothing of the slightest import?

But, if you can bear it, read what follows. . . .

Do you remember conveying me to the funeral at 3 p.m., when the 12 h.p. tumbril covered the two miles in one second?

On entering *La Salle d'Ivoire* I noticed that Bousanquet was not present.

"What about your infernal gas, Mac?"

"I'm not for giving you gas twice in one day."

"Oh! Then—then I suppose Bosky has gone to the theatre to collect the chloroform gadgets."

"No; he has not."

"Then, confound you, what does it all mean?"

"This will be a long and difficult job in which you must help me. You can't help me if you are under a general anæsthetic, so I shall use cocaine on the brute."

You follow? The duplicity of the thing; the enticement under false pretences; the refusal of Bousanquet to be a party to the shameful proceedings; the appearance of the Highlander under his true colours at last?

A crooked, deceitful race; and the Skye brand leads the van.

And what effrontery—"the brute," forsooth!

"What do you mean by the 'brute'?" I asked in a low, quiet, vibrating voice—if there is such a kind of voice.

I was secretly delighted to note that The Macrimmon turned pale and looked nervous. "Why, your amalgam mine, of course," he replied.

I wrote the name "Egbert" on one of my visiting cards which, after flaming, I placed in a prominent position on the miniature merry-go-round. It is useless trying to explain an intimate matter of that kind to a man like The Macrimmon.

The Macrimmon bet me his shirt, his boots, his good name and his reputation that the *séance* would be painless. But, as he would not bet me a day's pay, I knew what value to set on his assurances.

Later on I found that my estimate was correct.

He began by placing a pit prop between my jaws. To the prop was fastened a stout wire hawser which, in turn, was spliced to a grappling iron. The latter was made fast to a hole in the carpet. My neck was acutely retroflexed, until my occiput fitted into the head rest. When The Macrimmon wished to bring my head forward, he pulled on the hawser and inserted the iron into another hole. This arrangement he tested several times (" You look quite comfortable"), twirled the merry-go-round ("Now we shan't be long") and turned on the soda-water fountain.

"Owthellamitogurcehwaooo?" I inquired.

For answer The Macrimmon stabbed me.

It is some time since the lancer regiments were deprived of their favourite arm. Why, then, should the A.D.C. be allowed to retain it? Is there no method less barbarous than this for the administration of cocaine? The War Office has declared the weapon to be obsolete; is its embargo to be flouted? Does the A.D.C. not understand the meaning of the word *finesse*?

The Macrimmon stood by and watched me while I asked these questions.

"Sorry. I'm afraid the prop is in the way. I don't understand. Still comfortable?" and he stabbed me again.

He stabbed me six times.

The right side of my tongue felt like a piece of New Zealand mutton crossing The Line, but Egbert was far from being subdued; in fact he was distinctly annoyed.

The Macrimmon glanced at the clock, selected a claymore ("There will be no tenderness or sensation now"), raised it to a white heat and plunged it into the former resting-place of the ·415 bullet.

The effect was very satisfactory. It proved to me—and to The Macrimmon—that my reaction time was about equal to the speed of wireless. The Macrimmon received a kick on the shin, the mark of which I trust he will bear for the remainder of his life. He has since confessed to Bousanquet that it was twice as painful as any he received in the shinty final, Ballachulish *v.* Oban.

I wonder if there is a special Hell for dentists who use the heated claymore?

He stabbed me six times more. Total, twelve times.

Egbert was now paralytic. There was no pain—or at any rate, no pain commonly called "pain." It is difficult—and harrowing—to recollect and describe it. No pain, just anguish; just delicate, doleful, third-degree, diabolic, distressful ANGUISH.

Dearest Georgina—allow me to pass over the next thirty minutes as rapidly as possible; aye, even though they actually occupied thirty long years.

Shall I recount that cataclysmic moment when Egbert was sundered in twain?

Shall I describe the shattering of The Macrimmon's favourite pair of dreadnought, nickel-plated, presentation tongs?

Shall I tell you how this cursed Jacobite delved with a spade, prised with a crowbar, wrenched with a vice and hauled with block and tackle, while the merry-go-round spun on its axis and the soda-water fountain foamed and sprayed?

You have listened to Mr. Carr Lynn of the B.B.C.—the gentleman who imitates the lions at feeding time.

Georgina—he is an amateur; you ought to hear me. I can imitate the whole Zoo, before, during, and after, feeding-time. I can do it, too, when I am curled up like a periwinkle, and with my oral cavity filled with pneumatic Tarmac drills functioning like a battery of German machine guns.

But far be it from me to boast, Georgina. Even I am a poor thing. Hear The Macrimmon: hear The Macrimmon swearing in ta' Gaelic. O . . .

After three hundred grisly years I surrendered, the beloved Egbert succumbed, and The Macrimmon, victorious, transferred his props, grappling irons, lances, tongs, spades and crowbars to a cauldron. Despite his triumph, I thought The Macrimmon looked somewhat subdued. He whistled to himself, softly.

The tune was "The Barren Rocks of Aden."

Enough!

The curtain has fallen.

I address this epistle to you, dearest Georgina, in the hope that you may benefit by my experiences.

Two lessons:—

(1) Join the Safety First movement.

(2) Vote Conservative.

Toujours à toi.

Editorial.

THE BACTERIOPHAGE.

In the year 1911, while engaged on the mass production of a cocco-bacillus which was being used for the destruction of locusts, d'Herelle observed that some of his cultures showed irregularities of the colonies and also apparently bare areas in the midst of a confluent growth. This suggested to him that there was, mingled with the culture, some invisible agent which at times inhibited the normal growth of the bacterium. The original cultures of the cocco-bacillus had been isolated from the intestinal contents of locusts, and he decided to make further investigations with fæcal material, selecting the stools of cases of dysentery and typhoid fever as affording the prospect of a useful field of work. In the first years, during which this research was pursued with a pertinacity which we must all admire, the stools chosen for study were mostly those of patients in the severe stages of the diseases, and results were most disappointing. In 1916 a case of severe dysentery was studied by successive daily examinations. On each occasion a portion of the filtrate of the stool was inoculated into a tube of broth which had previously been planted with Shiga bacilli. For several days the results were quite negative, normal cultures of the dysentery bacillus developing, and then, on a day corresponding with a notable improvement in the clinical condition of the patient, the test broth tube remained sterile. A quantity of fresh Shiga bacilli, sufficient to produce a marked turbidity, was then added to the broth tube, and this was returned to the incubator. After ten hours the fluid was again quite clear. Inoculation of a small quantity of this clear fluid into another broth culture of the bacilli again caused the disappearance of the organisms. This process could be repeated indefinitely; a small amount of the cleared fluid resulting from the treatment of one culture was capable of causing the complete disappearance of the bacilli from another culture. It was noted during these repetitions that the time required for solution of the bacteria tended to become shorter after a number of passages. It was also found that the power of the clear fluid to dissolve the bacilli was retained after filtration through a porcelain filter.

In order to explain these happenings, d'Herelle formulated a theory to the effect that the stool of this case of dysentery contained a filtrable living principle which had the power of dissolving Shiga bacilli, and of increasing in activity at the expense of the bacteria. To this lytic principle he gave the name "bacteriophage."

In 1915, prior to d'Herelle's first publication on the subject of bacteriophage, Twort, working in London, described a phenomenon which subsequently appeared to be closely related to that investigated by d'Herelle.

In the course of his researches into the bacteriology of vaccine lymph, he isolated on many occasions a white micrococcus. Some of the colonies of this on solid media were observed to behave in a peculiar manner; they became glassy and transparent, and when portions of this glassy material were stained by Giemsa's method no cocci were to be seen, but only minute reddish granules. The change in the appearance started at the edges and spread throughout the colonies. A normal colony could be inoculated with material from a degenerated one, and then itself became subject to the same degeneration.

D'Herelle maintains that this phenomenon is quite distinct from that of bacteriophagy, because the action of the bacteriophage is to cause complete dissolution of the bacteria, and not merely a change into a glassy substance. This argument does not seem strictly compatible with his own description of the process of bacteriophagy, to which we shall refer later.

The general trend of opinion appears to be that the Twort phenomenon and the d'Herelle phenomenon are identical, and in support of this view A. Gratia, of the Pasteur Institute at Brussels, states that, starting with a bacteriophage for staphylococcus which fulfils d'Herelle's stipulations, he can reproduce the formation of the glassy substance of Twort, and also that if the transparent material developed from micrococci derived from vaccine lymph be inoculated into a broth culture of staphylococci the typical phenomena of bacteriophagy are reproduced.

D'Herelle has continued his studies, and the subject has attracted the attention of other workers, more especially on the Continent. We shall endeavour to deal with the broad lines of the investigations and the deductions which have been made from them.

The dysentery bacilli, Shiga and Flexner types, offer a convenient field for this study, and a large part of the investigation has been made with them. The procedure recommended by d'Herelle for obtaining a dysentery bacteriophage is to take a sample of fæces, preferably from a convalescing case of dysentery, suspend it in water or broth and filter the suspension through a porcelain filter. The filtrate is then tested by adding a small quantity to a young broth culture of dysentery bacilli and spreading a portion of the mixture on an agar plate. The broth culture and the agar plate are placed in the incubator and examined from time to time. If the specimen of fæces contained active bacteriophage the broth culture will be found to have become quite clear in from ten to twelve hours, and no trace of bacillary bodies can be demonstrated in it. The agar plate will show a growth of the organisms with a number of circular bare areas on which no signs of any growth are visible. D'Herelle calls these areas "plaques," and considers that each represents the position of a bacteriophage corpuscle which has dissolved the bacilli endeavouring to grow within its sphere of action.

He noted that the plaques were of different sizes, those produced by

some races of bacteriophage being small while others were much larger, reaching in some cases a diameter of eight millimetres. He attributed these differences in size to different degrees of activity on the part of the bacteriophage, that producing the largest plaques being the most active. If incubation be continued the plaques do not become overgrown. The presence of a bacteriophage may be demonstrated by inoculating a broth culture of the bacilli with a platinum wire which has been touched on the centre of the plaque, when typical bacteriophagy will ensue.

Gratia studied the formation of plaques and found that there were apparently three types of plaque, a small type which regularly produced small plaques when subcultivated through alternate solid and liquid media, a large type, and a variable type. Philip Hadley, as the result of his own observations and a review of the work of others, considers that there are only two types of lytic principle, one producing small plaques, the other large. A mixture of these two types would give rise to the intermediate sizes.

If the clear fluid resulting from the action of the bacteriophage on a broth culture of a susceptible organism, or a filtrate of the same, be inoculated into a fresh broth culture of the same susceptible organism, the phenomenon of bacteriophagy will be reproduced. This can be repeated indefinitely, and d'Herelle has thus maintained a race of bacteriophage for ten years.

The process of bacteriophagy may be studied under the microscope by taking samples at intervals from the culture and making stained preparations from them. The first sign of change is the presence of badly-staining bacteria. These increase in number, and amorphous debris and granular matter become noticeable. After this a few relatively large spherical or ellipsoidal forms may be observed. In the later stages all bacterial forms have vanished and, finally, all traces of the granular debris disappear. When the early stages of the process are observed in a living culture, under dark-ground illumination, the vast majority of the bacteria will appear normal, but among them will be seen a few "inflated" forms. The largest of these will be completely spherical. If one of these spherical forms be kept under careful observation, it will be seen suddenly to burst, leaving in its place a slightly cloudy floccule, which slowly dissolves.

From these observations d'Herelle argues that the bacterium is penetrated by the bacteriophage, which grows and multiplies within its body in true parasitic fashion, becoming liberated into the surrounding fluid by the final rupture of the bacterial envelope.

Working on the lines indicated above, bacteriophage has been cultivated for a considerable number of organisms. It is not, however, always easy to secure a successful result. Klosterman and Small tested more than thirty stools in the endeavour to find a bacteriophage active against virulent diphtheria bacilli, and were successtul in only one instance.

The early experiments showed that the active material is capable of passing through a porcelain filter and also that the fluid containing it,

when examined under the microscope by various methods, shows no evidence of visible particulate matter. It would, therefore, appear that the bacteriophage is either in solution or in suspension in the form of ultra-microscopic particles. D'Herelle upholds the latter explanation. One of the most interesting experiments bearing on this point was carried out with a series of collodion membrane filter sacs of graduated permeability. With these he found that the bacteriophage passed through the coarser membranes, but was held back by the finer ones. Comparative tests with serum indicated that the bacteriophage particle is slightly smaller than the micella of serum-globulin. His results are in agreement with those of other workers, and it appears that the bacteriophage is of approximately the same size as the viruses of rabies and vaccinia.

D'Herelle claims to be able to enumerate these "corpuscles" in a suspension by adding known quantities of high dilutions of bacteriophage suspension to fixed volumes of broth culture, plating out a fixed amount of the mixture, and counting the resulting plaques. This method must, of course, be subject to the same kind of inaccuracies as are encountered in attempts to enumerate bacteria by plating and counting resulting colonies. However, in d'Herelle's experiments the results seem to have been consistent, and he found that when varying amounts of the same bacteriophage suspension were used, the number of plaques was directly proportional to the quantity of suspension mixed with the culture.

D'Herelle showed, and it is now generally agreed, that true bacteriophagy only takes place in cultures which are in favourable circumstances for growth. It does not occur, for example, in saline suspensions nor in suspensions of dead bacteria. He found also that the bacteriophage is relatively resistant to heat, having in some cases withstood a temperature of 70° C. for half an hour. Hadley found that the lytic principle derived from large plaques was inactivated by heating for thirty minutes at 63° C., but not at 60° C., and that the principle from small plaques resisted a temperature of 70° C. It is, therefore, possible to kill many kinds of bacteria in a mixed culture without destroying the bacteriophage.

The fact that, in a long series of demonstrations of bacteriophagy, the inoculation of a small quantity of suspension gives rise to a large amount of a similarly active suspension, led d'Herelle to the conclusion that the bacteriophage is capable of regeneration. Taking this into consideration with its corpuscular nature, he maintains that the bacteriophage is a living organism which grows and multiplies at the expense of living bacteria. He considers it to be a separate living entity which parasitizes the bacterium, and thus causes its destruction. Since the publication of this hypothesis many alternative explanations of the known facts have been put forward. Of these, that which has had most support up to the present time is the theory of Bordet and Ciuca, first published in 1920. They consider the bacteriophagic reaction to be an autolysis resulting from the rupture of the equilibrium existing between assimilation and metabolism

(nutritive vitiation). According to their view, this vitiation has its origin in a normal physiological characteristic of bacteria; but, under certain conditions, or at the instigation of certain bacterial cells, it may acquire a pathological significance in the life of the cell or culture. After certain bacteria have experienced this vitiation, they may communicate the condition to surrounding sensitive cells by the products of their autolysis, and the reaction thus may be transmitted in series. Hence it appears that Bordet considers the possibility that the bacteriophage may not itself possess a lytic function, but that it may be an exciter of autolysis.

This theory is consistent with what now appears to have been definitely proved, namely, that the bacteriophage can be developed from apparently pure cultures of bacteria, without the intervention of filtrates from intestinal contents or similar material. The lytic principle can be developed by keeping normal sensitive broth cultures for fourteen days at a temperature between 8° and 10° C., or by repeated subculture in their own filtrates, or by the addition to cultures of solutions of pancreatin or trypsin which have been heated to 120° C., or of solutions of lithium chloride.

It is also in agreement with the fact that bacteriophagy only takes place in connexion with living cultures, a point which d'Herelle's theory fails to explain.

In the course of a study of the various forms to be found in a culture of *Vibrio metchnikovi*, Kuhn observed the occurrence of spore-like "involution forms," followed by the development of large spherical cells to which he gave the name Pettenkofer bodies. These are said to burst with the liberation of minute granules. The addition of 0·1 per cent of lithium chloride to a culture medium results in a plentiful development of these bodies, and filtrates from such cultures exhibit the bacteriophagic property. Kuhn considered that the granules are parasites of the bacteria, but Hadley regards them as being a stage of one of the developmental cycles of the bacterium, and suggests the possibility that they may be connected with a sexual type of reproduction. This theory is more easy to accept when we remember that filter-passing stages have been demonstrated for a number of bacteria, including the tubercle bacillus, *B. typhosus* and the fusiform bacillus. Hadley and his colleagues have shown that these filter-passing forms can be subcultivated and gradually assume a visible coccal form, returning after many generations to the original bacillary type.

It would appear that Hadley accepts the theory of Bordet and Ciuca as far as it goes, and adds to it a hypothesis that the principle which causes the production from the bacteria of the lytic substance is connected with the abnormal development of a certain stage in the microbic life-cycle. It is almost inconceivable that the life-cycle of any organism should include a suicidal phase, for this would ensure the ultimate destruction of the race, and so Hadley's suggestion, though it may prove to be a step on the way, does not afford a final solution to the problem.

We may now return to the consideration of some of d'Herelle's

experimental work, which is of undoubted value in so far as it relates to observed facts, however severely his deductions may be criticized.

There appear to be several races of bacteriophage, each capable of causing the lysis of certain groups of bacteria. Thus a bacteriophage which is most active against Shiga bacilli will usually also affect the Flexner types, *B. coli* and some strains of *B. typhosus*. The degree of virulence against a particular organism of the group is not fixed, and may become enhanced or diminished. D'Herelle divides bacteria into homogeneous and heterogeneous species. When one strain of a homogeneous species is susceptible to a particular bacteriophage, all strains of the same species will be susceptible; examples of these are the Shiga dysentery bacilli and *B. pestis*. On the other hand, he classes *B. typhosus* as heterogeneous because certain races of typhoid-bacteriophage are extremely specific in their action, attacking but a single strain of *B. typhosus*. It is remarkable that out of some thousand examples of bacteriophage isolated by d'Herelle, he has not found two which exactly correspond in all respects one to the other.

The experiments referred to above, in which complete and permanent clearing of the fluid culture has resulted, have been carried out with highly active bacteriophage, that is to say, with bacteriophage of great virulence with regard to the bacterium under test and operating under favourable conditions. There are, however, races of bacteriophage of varying degrees of virulence, and also strains of bacteria with different powers of resisting bacteriophagy.

If a culture of bacilli of normal resisting power be inoculated with a bacteriophage of moderate virulence, the culture becomes clear after a short time, but if incubation be continued, a turbidity is again produced by the development of a secondary growth of the bacilli. Filtration at this stage shows that the bacteriophage is still present, though unable to overcome the secondary culture. The same effect can be produced with a virulent bacteriophage if it be subjected to unfavourable conditions, such as an excess of acidity in the medium. Repetition of the process tends to produce a strain of bacteria of high resistance to the bacteriophage. On the other hand, bacteriophagy of an easily susceptible organism under optimum conditions for the bacteriophage enhances the virulence of the latter. Thus, in the conflict between the bacterium and the bacteriophage it appears that the victor comes out with increased strength. Where there is no conflict, as, for example, when a highly resistant bacterium has been completely freed from bacteriophage, and is then cultivated through several generations, the enhanced power of resistance is lost.

Prausnitz has also shown that by placing the bacteriophage in contact with corrosive sublimate solution or phenol, he was able gradually to produce races which resisted concentrations of these disinfectants which were fatal to unaccustomed races.

This faculty of adaptation to environmental conditions is considered by

d'Herelle to be an additional evidence that the bacteriophage is a living thing, and it is indeed hard to believe that it can be accounted for on a purely physico-chemical basis.

It is possible to reach a condition of balance in which a culture may contain a high proportion of resistant organisms and be, at the same time, contaminated by a moderately virulent bacteriophage. Such cultures are apparently quite normal in their growth, but the presence of bacteriophage may be demonstrated by inoculating a filtrate into a culture of a non-resistant strain of the same type of organism. Such mixed cultures are sometimes found among laboratory stocks, but only on rare occasions, since the conditions under which stock cultures are maintained are not on the whole favourable for the development of bacteriophage, and it usually dies out, leaving a pure, non-resistant bacterial culture. It is otherwise in the case of cultures derived from natural sources, such as pathogenic conditions of man or animals, in which it is relatively common to find the bacteriophage associated with the bacteria. The comparative facility with which the bacteriophage is discoverable in convalescent cases renders plausible the conception that it may play an important part in the natural recovery from disease. In a series of dysentery cases studied at the Pasteur Hospital the virulence of the bacteriophage derived from the patients' stools was found to show a marked rise coinciding with the commencement of recovery. The study of this point is beset with difficulties. It is usually necessary to test the bacteriophage against a laboratory culture, for the strain infecting the patient tends to develop enhanced powers of resistance to the bacteriophage with which it is in contact. In the case of typhoid bacteriophage its action is so specific that there is little sign of connexion between the course of the disease and the virulence of the bacteriophage for stock cultures.

D'Herelle noted some interesting points in connexion with the characters of those organisms which had become highly resistant to the bacteriophage. He found them to be slightly or not at all agglutinable in the presence of the specific antiserum. Freshly isolated cultures might often, according to his theory, come into this category, and it is well known that they are frequently insusceptible to agglutination. He noted, also, that whatever their source, they tended to grow in coccal forms, and he considered them to be more virulent to animals than the normal cultures. Philip Hadley, whose studies of bacterial dissociation are of great interest, has gone more deeply into this matter. According to him, the secondary colonies arising after the action of the small plaque-forming lytic principle are of the "S" (sensitive, smooth) type, while those following the action of the large plaque-forming principle are of the "R" (resistant, rough) type. Colonies resistant to the large plaque-forming principle are sensitive to the small plaque-forming principle and conversely, and thus a mixture of the two principles constitutes a very strong bacteriophage capable of dissolving both "R" and "S" types of organism.

D'Herelle has carried out a large number of experiments on the immunization of animals by means of inoculation or ingestion of the appropriate bacteriophage. As the suspensions employed contained, in each case, products of the solution of bacterial bodies, it is almost impossible to assess the value of his results, and it would be futile to attempt to discuss them here. However, there is one point in connexion with these experiments which is of special interest, as it has a bearing on his employment of bacteriophage in the treatment of disease. If an animal receives a considerable number of inoculations of a bacteriophage suspension, its blood-serum is found to develop a substance which inhibits the normal action of bacteriophage. The presence of this substance is stated to render the animal unusually susceptible to the corresponding bacterium, and thus to outweigh the immunity which might be expected to result from the injection of dissolved bacterial matter. On this account it is recommended that, for therapeutic purposes, not more than two inoculations be given in each case.

It is possible to remove from this antibacteriophage serum, by an application of Castellani's absorption method, all traces of antibacterial properties. This has been done by Wollman, Otto and Prausnitz. They consider that this is proof positive that the substance of the bacteriophage is chemically distinct from that of the corresponding bacterium. This conclusion may not be generally accepted, for it is known that the different types of colony derived from any one organism differ in their serological qualities.

Following on the laboratory researches, the question of applying the knowledge that had been gained to the treatment of human disease was naturally of great interest. Before commencing any experiments on patients, d'Herelle satisfied himself that ingestion and subcutaneous injection of suspensions of Shiga bacteriophage (at least a month old) gave rise to no appreciable reactions. After this he tried plague bacteriophage, and Eliava tested that for staphylococcus.

The first experiments were made with cases of Shiga dysentery, in which the causative organism had been identified, and in which no bacteriophage virulent for the Shiga bacillus could be discovered in the stools. Particulars are given of five cases treated in hospital and two outside. Each received 2 c.c. of Shiga bacteriophage by the mouth. No other treatment was given. Rapid improvement followed and bacteriophage, strongly virulent for Shiga's bacillus, became demonstrable in the stools. A trial on a large scale was carried out in Brazil under the direction of da Costa Cruz, who reported very favourably on the results, and the method has been tried in various other places since then.

Pereira, reporting in 1924 on twenty-three cases of bacillary dysentery, treated with conspicuous success by means of bacteriophage, lays stress upon the fact that recovery was complete, both clinically and bacteriologically. He argues that this method would obviate the development of carriers.

Many observers have reported unsatisfactory results from this line of treatment. D'Herelle emphasizes that it is essential to employ a race of bacteriophage having a very high degree of virulence for the organism concerned, and the importance of this can be realized when we consider that the patient is, in all probability, infected with a virulent and highly-resistant bacillus. Some of the cases of failure in treatment were undoubtedly due to the employment of bacteriophage, the activity of which had been overestimated.

According to d'Herelle's account, the bacteriophage would appear to be of very considerable value in colon bacillus infections, such as pyelonephritis and cystitis. In these cases it is necessary to employ a bacteriophage which has been ascertained to be virulent for the invading strain of bacilli; it may be administered both subcutaneously and by the mouth. D'Herelle recommends that not more than two inoculations be given, as a large number might produce a lowered resistance to the bacillus, and also because he finds, as a matter of experience, that if improvement does not immediately follow, further inoculations are futile. He quotes an old-standing case of cystitis which failed to respond to subcutaneous inocuations, but which was permanently and rapidly cured by an instillation of the same bacteriophage into the bladder.

In the treatment of typhoid fever the administration of bacteriophage has not given promising results. Certain observers have noted dramatic improvement in some cases and no appreciable effect in others. It is possible that the cases of improvement were merely coincidences. The question of specificity for the invading strain of *B. typhosus* has been allowed for, the activity of the bacteriophage having been tested against the patient's strain *in vitro*. Hauduroy found that bile has the power of inhibiting the action of the bacteriophage, and hence bacilli in the gall-bladder are immune from its effects. This may partially explain the failure of bacteriophage in the treatment of typhoid fever, but there must be other factors which have not yet been ascertained.

The earlier attempts to cultivate a bacteriophage for cholera met with very little success. D'Herelle investigated 100 cases in Indo-China, ninety-nine of which were fatal, and in these he failed to demonstrate bacteriophage. In the case which recovered he was able to demonstrate the existence of bacteriophage by the development of plaques, but he did not succeed in cultivating it. Meissner obtained a cholera bacteriophage from the exudate produced by intraperitoneal inoculation of a guinea-pig with a mixture of *V. choleræ*, the Tor vibrio and an anticholera serum. Recently d'Herelle and Malone studied twenty-three cases in the Campbell Hospital, Calcutta. In three cases which proved fatal within twenty-four hours no bacteriophage was present on admission. In another three the bacteriophage was weak from the start and became weaker; these patients died within twenty-four hours of the disappearance of the bacteriophage. In the majority of the cases the bacteriophage was weak at first, but became stronger as the

patients progressed towards recovery. It was concluded that recovery or death depended upon the presence and behaviour of the bacteriophage.

With virulent races of bacteriophage obtained from these patients experiments were carried out in the treatment of cases occurring in the course of an epidemic affecting four villages, where it may be assumed that other modern methods of treatment were not fully available. Forty-one patients were treated, and of these three, or 7·3 per cent, died. In the same villages, out of 107 cases untreated with bacteriophage, seventy, or 65·4 per cent, died. These figures are very impressive.

The prompt notification of an outbreak in another village rendered possible a very original experiment in prophylaxis. Six cases of cholera, of which three proved fatal, occurred on August 2, while six further cases with two deaths occurred next day. On August 4, 30 c.c. of bacteriophage suspension was added to each of the two wells supplying the affected area. No further cases were reported, and the patients who drank the water from these wells recovered. The idea underlying this experiment was that all persons who were likely to become infected by drinking from the contaminated wells would at the same time receive a dose of highly active bacteriophage.

It is quite possible that the abrupt termination of this epidemic may have been due to causes other than the treatment of the wells, but, if supplies of bacteriophage are kept ready, it should be easy to repeat the experiment until a conclusive result be obtained. We understand that this research is being continued under the auspices of the Indian Research Fund Association.

Other workers in India are interested in this study, and this year W. C. Ross and his assistants have published the results of their trials of the method. Out of sixteen cases nine were treated with bacteriophage with one death. At the same time seven cases were treated in other ways with three deaths. Among five cases from another village treated with bacteriophage there was one death. This observer considers that d'Herelle's theory of the part played in immunity by the bacteriophage goes far towards explaining the observed facts in connexion with the epidemiology of cholera.

Just as in an individual case the development of active bacteriophage may be associated with convalescence from the disease, so, in d'Herelle's opinion, the dissemination of virulent bacteriophage may be a determining factor in the subsidence of an epidemic. He has made a number of observations on avian typhosis, and found that after feeding a few chickens in an infected flock with the appropriate bacteriophage, it became demonstrable in the fæces of the remainder and the epidemic came to an end. In cases like this, where the source of infection is through the ingestion of material contaminated by fæces, the bacteriophage is transmitted concurrently with the infecting organism. On this basis may be explained the course of an epidemic of cholera in which there are at first a large number of fatal cases, and later, as the bacteriophage gains in virulence, a

diminishing number of milder cases while the disease spreads into previously unaffected localities.

It is now more than eleven years since d'Herelle first published his notes on the phenomenon. That these were received with a considerable degree of scepticism is not surprising, but the confirmatory results obtained by the small band of investigators who followed his early work gradually brought the subject into greater prominence in this country, and it was made a subject for discussion at the Annual Meeting of the British Medical Association, at Glasgow, in 1922. During recent years the number of references to the bacteriophage in the medical journals has been steadily increasing, and there is no doubt that there is here an important field for further research. Progress will inevitably be slow, for we are hampered at every turn by the difficulty of observing reactions involving the presence of ultra-microscopic particles; but so many scientists are engaged on the study of the true nature of bacteria, and the physical and chemical conditions which affect precipitation and solution of organic matter, that it is not unreasonable to expect that the next few years will show a remarkable increase of our understanding of the basic facts of infection and immunity.

Up to the present the practical application of d'Herelle's methods cannot be said to have demonstrated the correctness of his theories, nor, on the other hand, have they been completely disproved, but there is no doubt that his pioneer work has been of inestimable value in opening up new lines of thought and in stimulating research into the fundamentals of bacteriology.

Clinical and other Notes.

NOTES ON A CASE OF SEPTICÆMIA CAUSED BY INFECTION WITH *BACILLUS WELCHII*.

By Major C. D. M. BUCKLEY, M.C.
Royal Army Medical Corps,

AND

Lieutenant G. F. TAYLOR
Indian Medical Service.

The following case would appear to be sufficiently obscure and rare to be recorded.

A mochi (Indian shoemaker) attached to the Royal Artillery was admitted to the Indian Military Hospital, Quetta, on May 5, 1928, not having reported sick previously, but having complained for the previous fourteen days of bleeding from the gums, fever, and passing blood in his urine. He had been treating himself with "country medicine," a sample of which could not be obtained for examination.

On admission to hospital his temperature was 99·6° F., pulse 96, respirations 24. Mentally he was perfectly clear, and although obviously seriously ill was very optimistic about his condition. The following was the result of a preliminary examination :—

Heart sounds weak, but no murmur present.

Respiratory system : Normal.

Abdomen : Normal.

Spleen : Not palpable.

Gums : Spongy and hæmorrhagic in places.

Uvula : Œdematous and there were large hæmorrhagic areas present in the left soft palate and tonsil.

Skin : About three dozen petechial hæmorrhages were unevenly scattered throughout the body.

Conjunctiva : Three small hæmorrhages.

Central nervous system : Normal.

Urine : Contained a large amount of fresh blood, microscopically red blood-cells were present, also a few granular casts ; no blood-casts.

Blood examination : Negative for malaria, total red-cell count 3,150,000 per cubic millimetre, no abnormal red cells seen ; hæmoglobin 50 per cent, white cells, 3,750 per cubic millimetre; differential blood count : polymorphs 21 per cent ; lymphocytes, 61 per cent ; large mononuclears, 18 per cent. Wassermann reaction was negative, no sign or history of syphilis.

A swab was taken from the throat, also a blood culture, which were sent

to the laboratory for examination. At this stage the diagnosis seemed to rest between the following: (*a*) Scurvy; (*b*) some obscure blood disease; (*c*) poisoning by some Indian drug; (*d*) streptococcal septicæmia; (*e*) purpura hæmorrhagica. The last diagnosis was provisionally made.

Clinical course: The patient rapidly went downhill, did not respond to treatment and died on the fifth day.

During the five days he was in hospital he passed large quantities of blood in his urine; his death was apparently due to exhaustion and heart failure. The patient was treated with intravenous injections of calcium chloride and hæmoplastin with no beneficial result. Blood transfusion was considered, but was not thought to be advisable.

A post-mortem examination was carried out, and the following findings were noted:—

Body: Emaciation not marked, numerous subcutaneous petechial hæmorrhages present, as already described, no wound or abrasion.

Chest: Both pleural cavities obliterated by old firm adhesions.

Lungs: Some congestion at bases.

Mediastinum: No enlarged glands present.

Heart: Pericardial fluid slightly increased in amount and tinged with blood. Half a dozen petechial hæmorrhages present on visceral layer of pericardium. No active pericarditis.

Peritoneum: Numerous large hæmorrhages under the visceral layer. One large retro-peritoneal hæmorrhage on right side of pelvis and round right kidney. No enlarged lymphatic glands, no peritonitis.

Liver: Right lobe of somewhat spongy consistence and in appearance resembled lung. Left lobe normal. No hæmorrhages present.

Spleen: Small and somewhat fibrosed.

Kidneys: Left, two small hæmorrhages into apices of pyramids, otherwise normal. Right, hæmorrhages into pelvis of kidney, which was filled with blood-clot. Cortex congested.

Bladder: Filled with blood-clot, mucous membrane greatly thickened and hæmorrhagic.

Stomach: Hæmorrhagic in places.

Intestines: Distended; numerous hæmorrhages into mucous membrane.

Specimens of liver, lung, kidney, bladder, and spleen were taken for the purpose of making sections.

On examination of the sections, infection with *B. welchii* was immediately suspected, and the original blood-culture, which had been taken before death and which was still in the incubator, and proved sterile on being grown aerobically, was re-inoculated into milk and grown anaerobically. *B. welchii* was grown out in pure culture, which was afterwards proved biochemically, culturally, morphologically, and by animal experiment.

No similar case can be found described in the medical literature available in Quetta. The chief points of interest of the case seem to be:—

(1) Whether *B. welchii* was responsible for the disease as a whole, or whether it was a terminal infection.

(2) Method of entry of the invading organism. No cutaneous wound was present; entry was probably effected through the left tonsil.

(3) The close resemblance of this case to purpura hæmorrhagica, and the possibility of such cases being really due to an infection with a similar organism.

(4) The abnormality of the white cell count, i.e., leucopenia with relative lymphocytosis of sixty-one per cent, and polymorph decrease to twenty-one per cent.

We are indebted to Lieutenant-Colonel A. A. McNeight, I.M.S., commanding Indian Military Hospital, Quetta, for permission to publish the notes on this case.

A CASE OF MYELOCYTIC LEUKÆMIA.

By Major H. G. GODDING, M.C.
Royal Army Medical Corps

AND

Major J. M. MACFIE, M.C.
Royal Army Medical Corps.

The interest in the case of myelocytic leukæmia, which is shortly described in the following notes, lies in the enormous size of the spleen at the time of death, and in the comparatively short duration of the last phase of the illness.

The patient was a rifleman, aged 25, and with a total service of seven years, of which five and a half years had been spent in India. He was stationed in Landikotal, and had been employed for seven months as a dining-hall orderly. It is likely, therefore, that he was not regarded as one of the more robust members of his company. On August 17, 1927, he reported to his medical officer, complaining of pain in the left shoulder.

His medical history sheet contained seven entries. In February, 1921, he was treated at Netley for fifty-one days for iridocyclitis of the right eye. It is noted that the discs and fundi were normal, and the media clear. At Benares, in June, 1923, he was in hospital for eight days with benign tertian malaria, and for six days with iritis. He had a second attack of benign tertian malaria in July, 1923. In May, 1924, he was admitted to the Military Hospital, Peshawar, for iritis of the left eye, and remained under treatment for twenty-four days. In August, 1924, iridocyclitis of the right eye caused his admission to hospital for twenty-nine days, and in April, 1925, he was in hospital for five days with phlebotomus fever.

He was admitted to the Combined Indian Military Hospital, Landikotal, on August 17, 1927, and gave a history of having been rather constipated for the previous week, and of pain in the left shoulder for two or three days. He had had an attack of "shivers" while straining at stool that morning.

Examination revealed nothing abnormal in the chest, and palpation of the abdomen gave no information, owing to the great rigidity of the recti, especially the left. Percussion revealed a large area of dullness continuous with the splenic area and filling up most of the left side of the abdomen. The blood-picture showed an enormous increase in the leucocytes, and the presence of large numbers of myelocytes. No malaria parasites were found. The temperature at night rose to 100·4° F., and a soap-and-water enema was given with a fair result.

On August 18 he was transferred to the British Military Hospital, Peshawar. He was then a rather spare, slim man, of moderately good colour, who appeared quite comfortable in bed. The tongue was moist, lightly furred, and the respiration thoracic. The pulse was of good quality, regular, and eighty to the minute. The heart sounds were closed, and rather ringing in quality. Except for a few bubbling râles at the left base, the lungs were clear. The abdomen was tumid, there was no complaint of pain, and no tenderness on palpation or percussion. The flanks were tympanitic. A huge, hard mass occupied the greater part of the abdomen. It was immobile, dull to percussion, shading off to a tympanitic note, and had a notch at the right margin. The dullness was continuous with the area of splenic dullness in the left hypochondrium, and was continuous over the præcordium with heart dullness, reaching to the sixth rib in the left mid-axillary line. The upper limit of liver dullness was the fifth rib in the right mid-clavicular line, and the sixth rib in the right mid-axillary line. Digital examination disclosed ballooning of the rectum, and the absence of fæcal matter. No enlarged lymphatic glands were found, and the urine was normal. The gums were healthy, and purpura and visible hæmorrhages were absent, except for a small hæmorrhage in each retina. The result of the blood examination is given in the table which follows later.

On August 19, radiotherapy was applied to the spleen, and he was given at first, liquor arsenicalis, and later, potassium bromide.

The spleen steadily enlarged, and the general abdominal discomfort increased, although there was no complaint of pain. On the 24th there were small areas over the enlarged spleen which were tender to palpation. A turpentine enema was required daily. During the last four days the pulse rose to over a hundred, but the temperature remained normal all the time. He died quietly in his sleep at 5.30 on the afternoon of September 2, the seventeenth day after his admission to hospital. The lymphatic glands remained unenlarged, and there were no visible gross hæmorrhages. The urine on the day of death showed no abnormality.

The following table gives the results of eleven blood examinations which were carried out.

Early on the morning of September 3 a partial post-mortem examination was carried out.

The body was that of a small man, about five feet six inches in height, rather wasted, and with an enormously distended and very tense abdomen.

Rigor mortis was not well marked, and there was very little post-mortem staining.

The heart was large, pale and flabby, and weighed twelve ounces.

Date	Polymorphonuclear leucocytes	Myelocytes	Myeloblasts	Lymphocytes	Large mononuclears	Total leucocytes	Total erythrocytes	Hæmoglobin percentage
19.8.27	65·8	31·0	—	1·4	1·8	202,000	3,150,000	63 2
21.8.27	58·3	35·9	1·6	3·9	0·3	—	—	—
22.8.27	51·8	43·4	3·8	0·8	0·2	156,000	3,670,000	53·4
23.8.27	48·66	44·49	3·66	0·66	1·33	—	—	—
24.8.27	48·5	46·5	3·66	0·67	0·66	256,400	—	—
25.8.27	42·2	51·2	4·2	0·4	2·0	—	—	—
26.8.27	45·28	48·42	4·87	0·45	1·0	—	—	—
27.8.27	44·66	47·83	5·0	1·16	1·33	—	—	—
29.8.27	42·15	49·86	5·28	1·56	1·15	—	—	—
31.8.27	38 0	53·66	5·16	2·5	0·66	416,000	—	—
1.9.27	35·0	57·82	6·17	0·5	0·5	—	—	—

Note.—On August 21, the percentage of polymorphonuclear leucocytes included 1 per cent eosinophils and 1 per cent basophils; the percentage of myelocytes included 1 per cent eosinophils and 1·6 per cent basophils. During the counting of 300 white cells, three normoblasts and four megoblasts were seen. Diffuse polychromatophilia was present.

There was no fluid in either pleural cavity. The left lung had a few recent adhesions at the base, and showed some hypostatic congestion in the lower lobe. Otherwise it appeared healthy. All over the apical lobe of the right lung were old and dense adhesions, and the lobe was greatly congested, and full of blood-stained muco-purulent fluid. There was no sign of old tuberculous lesions in the lung substance. The left lung weighed twenty-four ounces, and the right lung thirty-two ounces.

There was a small amount of clear fluid in the abdominal cavity. No hæmorrhages were found, and no enlarged lymphatic glands.

The spleen occupied most of the abdominal cavity, and was found on removal to weigh exactly sixteen pounds, rather over thirty-six times its normal weight. Over the whole of the anterior surface were small, fine, recent adhesions easily broken down. Part of the anterior surface was overlapped by the left lobe of the liver, and at this place there were fairly firm adhesions requiring considerable force to break them down. The upper pole of the spleen was bound down to the under surface of the diaphragm by old and dense adhesions. The posterior surface was free from adhesions, and at the hilus the pedicle appeared to be almost non-existent. The spleen was rather soft and friable, and was of a dark, plum colour, with white patches over the anterior surface.

The liver was large, pale, flabby, and friable. It showed no sign of hæmorrhage and was of the same consistency all through. It weighed seven pounds twelve ounces.

The kidneys were large, but appeared normal, the capsule stripping readily. The left kidney weighed seven ounces.

The stomach and intestines appeared normal though somewhat

To illustrate "Fracture of Transverse Process of Fourth Lumbar Vertebra," by Major J. H. M. FROBISHER, O.B.E.

compressed. The large intestine was slightly increased in lumen and contained scyballa. No hæmorrhages were found.

The bone-marrow of the right tibia was of a bright pink colour all through.

The body decomposed in an unusually rapid and offensive manner.

Microscopic examinations were subsequently carried out with the following findings:—

Spleen: The whole of the pulp was stuffed with white cells of the granular series. There were numerous infarctions. The capsule and the stroma did not appear to be much thickened.

Liver: The lobular arrangement of a normal liver could not be distinguished. The liver cells appeared scattered in small groups of three or four among a vast collection of white cells. No evidence of necrosis was seen.

Bone-marrow: The cells of the bone-marrow from the shaft of the tibia were almost entirely myelocytes—neutrophil and eosinophil. There were a few myeloblasts, a few megalokaryocytes, and a few erythroblasts.

Lung: All the capillaries were filled with white cells. Microscopic areas of emphysema alternated with small, consolidated areas. Scattered through the lung was a considerable amount of pigment, some black, some golden yellow.

Heart: The muscle fibres appeared fairly normal, but were separated from one another by capillaries full of white cells.

Kidney: The tubules showed cloudy swelling of the epithelium with patchy desquamation. The glomeruli were very prominent owing to their capillaries being packed with white cells.

The declared course of this soldier's illness lasted only seventeen days, the predominant cell in the blood was the neutrophil myelocyte, the spleen at the time of death weighed sixteen pounds, and hæmorrhages were notably absent.

The above notes are published with the permission of the officers commanding the hospitals concerned.

FRACTURE OF TRANSVERSE PROCESS OF FOURTH LUMBAR VERTEBRA.

By Major J. H. M. FROBISHER, O.B.E.
Royal Army Medical Corps.

The following case and X-ray print of a naval rating admitted to the Military Hospital is forwarded, as it appears of some interest:—

Peter M., leading seaman, H.M.S. "R.," was admitted to hospital on July 25, 1927, suffering from "contusion right kidney." There was a history of patient being struck over the right loin by a block which carried away whilst he was assisting to spread the foc'sle awning on July 25, 1927. When seen after the accident there was only slight shock. Over the right

renal region there was a large contusion, a linear abrasion and a small lacerated wound. Patient was unable to pass urine. A catheter was passed without difficulty and about two ounces of blood-stained urine were drawn off. Examination on admission to hospital showed patient to be suffering from a large contusion, a linear abrasion, and a small lacerated wound over the right renal region. Examination of urine revealed the presence of blood and casts. X-ray examination revealed a fracture of the transverse process of the fourth lumbar vertebra. There were no signs of cord injury. Hæmaturia rapidly cleared up under treatment, and pain in loin soon disappeared. X-rayed at intervals, but the fracture did not appear to be uniting. The fracture was not considered of any serious import, and the patient was discharged to duty on August 29, 1927.

Echoes of the Past.

WHICH WAR?

By Major OSKAR TEICHMAN, D.S.O., M.C., T.D.
Royal Army Medical Corps (T.A.).

It is a far cry from the Charing Cross Road to St. Goar on the Rhine, but it was a sixpenny box in that bibliopolical thoroughfare which took us to this delectable spot, where the saint of that name first preached the gospel in the middle of the sixth century. Our purchase was an illustrated guide-book to the Rhine; the engravings were somewhat foxed, the joints were distinctly weak, and Mr. Baedeker might have scoffed at the date of publication, 1792. And yet as a guide-book it could give points to its descendant of 1927. The author's remark: ". . . St. Goar dont la situation merveilleuse surpasse tout ce que j'ai jamais vu, . . ." finally settled the question of a short summer holiday; besides, the journey could be made the whole way from London by boat, a great advantage in these days of crowded summer railway trains.

On a certain Sunday in August of last year, when the sun smiled on the vine-clad countryside, we crossed the Rhine from St. Goar with Hector, an ancient pointer belonging to our hotel, and walked a few miles down the right bank. The river was gay with the merchant flags of at least five nations, as if flaunting the mediæval castles which in olden times extorted tribute from many a passing ship. Now and then some fussy little motor boat, arrogantly flying the monarchist flag, would push its way through the heavily-laden barges and excursion steamers. On leaving this busy waterway, internationalized since 1918, we ascended some 800 feet and plodded for miles through orchards and cornfields, a country apparently destitute of

man or his habitation. Overhead the larks soared in a cloudless sky, and below Hector amused his companions by pointing at anything from a partridge to a frog or a grasshopper. Our goal was the tiny village of Prath, where we hoped to eat the sandwiches and peaches which we carried, washed down with good Rhenish. But Prath, like the desert *hod*, proved most elusive. Our track across the stubble dwindled to nothing; however, Hector came to the rescue and led the way. At length the village, nestling in a sleepy hollow and apparently wrapt in its Sunday siesta, came in view. Hector, having performed his duty, now disappeared; he had no use for Prath, possibly an enemy who had worsted him on a previous occasion dwelt there; at any rate we did not see him again until he met us on the outskirts of the village later in the day.

At the hostelry of the "Green Man" we deposited the rucksack containing our lunch, and called for wine, much wine. Mine host, awakened from his Sunday afternoon sleep, eyed us curiously as he drew the wine from a large cask.

"You are not foreigners, whence come you?"

Fortunately one of us had enough German to converse fluently. "Tell him that we come from Iceland," whispered one of our party. We did not pose as Icelanders, but told him that we had come all the way from London by boat. He took this as a good joke, but obviously did not believe it. In the little room in which we were lunching hung the usual framed and crudely-coloured picture denoting the "happy time" our host had spent during his army service in the 90's; and we realized that here we must be in a hot-bed of Prussian militarism.

But by this time the word had gone round Prath that foreigners were at the "Green Man," a unique occurrence in that tiny hamlet. Within ten minutes of our arrival about a dozen men, chiefly the village elders, trooped in, took their seats, and eyed us curiously. Old Anton (who looked at least an octogenarian) appeared, from the deference shown to him, to be the patriarch of the village. Would he and his friends take wine with us? Yes, they would be honoured to drink with the foreigners. Again the cask of Rhenish was broached, and our host appeared with a tumbler full for each villager, not forgetting himself. At Prath you drink your wine in a tumbler, and excellent it is at threepence per glass! Tongues were now loosened, and we asked the notables of Prath what their views were on the War. The reply was rather perplexing.

"What war?" said old Anton; "Aye, what war?" chimed in the rest.

For a moment the thought crossed our minds, had we stumbled on the one spot in Central Europe which had slept peacefully during the great upheaval? Surely an impossibility in the late German Empire.

We explained that we referred to the Great War, the war of 1914-18, a war of France and England against Germany.

"Oh, that war," said old Anton, "has never had the slightest interest for us, we did not want it; when we speak of *the* war, we mean our own war."

"Of course you refer to the Franco-German war of 1870," one of our party hazarded.

"Wrong again," cried the old man, "we did not care a rap about 1870, although some of our lads were forced to take part in it, as they did in the last war."

The situation was becoming obscure; a prolonged pause ensued.

"Have you foreigners ever heard of '66?" the old man suddenly exclaimed in a pitying tone.

"Yes, the seven weeks' war, Austria against Prussia, over Schleswig-Holstein, and the battle of Sadowa," we murmured.

Old Anton appeared relieved to hear that we knew something about *the* war; but his next question mystified us again. "Do you know what country you are in?"

"Prussian Germany," we replied, sure of our ground this time.

"No! No!" protested the old man in his high-pitched voice, at the same time thumping the table with his gouty fist till the glasses rattled, "they may call our country part of Prussia, but Nassau it is, and Nassau it will ever remain, *we* are not Prussians. Until '66 we were a free Duchy; in that unfortunate year our Duke sided with Austria against Prussia over the affair of Schleswig-Holstein. I fought in that war—was present at the battle of Sadowa—the accursed Prussian needle-gun defeated us—our Duke was deposed, Nassau became incorporated with Prussia. Have you not noticed the red and yellow flag, the colours of Nassau, at the top of the village? We fly it to proclaim our independence, every Sunday, but never the Prussian, Republican, or Monarchist flags!"

At the conclusion of this impassioned speech, which was occasionally interrupted by shouts of approval from the other villagers, glasses were refilled and all drank to the prosperity of Nassau.

As we emerged into the sunlit village street and saw the red and yellow flag floating lazily in the breeze, we pondered on the fate of this tiny Duchy, which had contributed its entire army of 4,900 men with two batteries of six pounders in the vain struggle against Prussia; and we rejoiced to think that after sixty years of subjection to the Prussian yoke, Nassau could now again maintain some sign of individuality by flying its national flag in the Republic of free Germany.

On the outskirts of the village we found Hector waiting for us. It never transpired why he refused to lunch with us, as had been his usual custom on our daily walks. But perhaps *he* was a Prussian.

Note.—The House of Nassau dates from the tenth century, and in the sixteenth century inherited the Principality of Orange. On the extinction of the male line of the Orange branch of the family by the death of William III of Holland, in 1890, the former Duke of Nassau became Grand Duke of Luxemburg.

Travel.

SHANGHAI—SOUTHAMPTON, VIA CANADA.

By Major F. R. H. MOLLAN, M.C.
Royal Army Medical Corps.

Rarely as it must fall to the lot of anyone in the Service to make the journey described below, yet it is hoped that an account of such a trip may prove of interest to readers of the Journal. We came to make the journey through being invalided home with "tummy trouble," and in company with one other officer and fifteen other ranks, embarked at Shanghai on August 6, on the S.S. "Empress of Canada," for Vancouver, British Columbia.

The "Canada," one of the most luxurious and beautiful ships afloat, and the premier ship of the Canadian Pacific Steamships' "Pacific Fleet," is an oil burner of 21,000 tons, and holds the trans-Pacific speed record. The "White Empresses" (the other ships of the fleet are the "Empress of Russia" and "Empress of Asia") connect Canada with the Far East, sailing from Vancouver via Japan to Shanghai, and thence southward to Manila in the Philippine Islands, and Hong Kong. They provide the shortest route between America and Asia, sailing in both directions every three weeks. The "Canada" was a revelation of what a modern trans-oceanic liner can be, especially one fitted out for a run where extremes of climate are met with during a single voyage.

Japan.

Japan was reached on the afternoon of August 8, and passing through the Straits of Shimonoseki, we entered the "inland sea" of Japan—a fairyland of bays and islands.

This sea is some 240 miles long, with a width varying from forty miles to places where there is barely room for two ships to pass. The glorious scenery reminded one strongly of the Scottish lochs—if one could imagine them on such a large scale. There are more kinds of islands than were ever set in any sea before—and strange craft manned by little brown fishermen, the sampans like toy boats swinging in the space between the islands.

Steaming along at night, the sea calm as the proverbial millpond, the lights of the towns twinkling in the darkness, and the ship's orchestra playing on the promenade deck, what a contrast to the heat and noise of a Shanghai night! Kobe, our first port of call, was reached early next morning, and here we had our first experience of the Japanese officials. Before anyone was allowed ashore the port doctor had to be satisfied as to

the health of the passengers, and a police "landing card" obtained, in addition to having one's passport viséd. Breakfast over, and the necessary "yen" (Japanese currency) obtained from the purser's office in exchange for a Canadian Pacific traveller's cheque, we set out to see as much as our limited time permitted. In Kobe there are golf clubs, bathing beaches, foreign as well as native stores, *thés dansants*, bridge parties, even a walking club, and all this mixed up with life as it might be led on a paper fan. The Japanese boy goes on his bicycle to school, but he wears his little white kimono-thing with big blue spots. His brother works in a telegraph office, carries an Ingersoll watch, but visits his grandfather who earns his living by fishing with twelve cormorants. (They swallow the fish down to their iron neck ring, when grandfather interferes.) The Japanese girl studies English, plays the piano, and has been known to bob her hair; but her mother takes her little paper lantern in hand, climbs at night to Mayasan Temple, and worships the mother of Buddha carved in ancient wood, one of the 300,000 pilgrims who keep in the ancient ways. We decided to spend the few hours at our disposal in visiting Kyoto which, for more than 1,000 years, and until 1868, was the capital of Japan. The train journey to Kyoto proved hot, but very interesting, particularly as we passed through Osaka, a city of 2,000,000 inhabitants, and the largest commercial city in the Japanese Empire. Kyoto, still the centre of the country's art, is a city wholly Japanese; it lies in a great green cup in the hills. The river that flows through its centre is crossed and recrossed with bridges, and every bridge has its story. The people of Kyoto have a genius for festivals, and will wait all night in boats to see the brilliant battle of the fireflies, who are known to be the ghosts of warriors dead and gone eight hundred years. Before he leaves for this festival, the good Japanese unfastens the door where his own little fireflies glimmer in their tiny bamboo cage, lest they, too, should chance to be warriors called to fight with the rest. In Kyoto are made the loveliest fans in all Japan, the quaintest dolls (some of which we purchased), the most marvellous silks, and the most beautiful china and pottery. Our time being limited, we had to content ourselves with "dashing round" in a taxi, but managed to see most of the sights worth seeing, including the largest Shinto temple in Japan, a truly wonderful edifice. The Mikado's palace is situated in beautiful grounds, but we could not gain entrance to the palace itself, as it takes about four days to obtain a permit for this purpose. The language difficulty arose when the inner man cried out for "tiffin"; however, we had an excellent luncheon in the railway station restaurant, where there was a special room for "foreigners," and where we were served by a Japanese "nippy," as pretty a picture as one could wish for, in quaint kimono and the sandals peculiar to the country. The Japanese love a joke, and those in the shop where we bought the dolls seemed highly amused at our method of bargaining. We selected our fancy, held the dolls in one hand and money in the other, and left the rest to the assistant, who retired giggling

hysterically to try and find someone who understood English—a fruitless search—so the good lady took what she wanted with bowings and smilings on either side.

The Japanese railway systems appear to be very efficient—large sections are electrified and the gauge approximates the English. A feature of the time tables and train departure notices is that they are printed in English as well as Japanese. At each station ice-cream was available, sold in neat cartons and apparently with every hygienic principle observed—we did not try the ices, however, though several American tourists appeared to relish them!

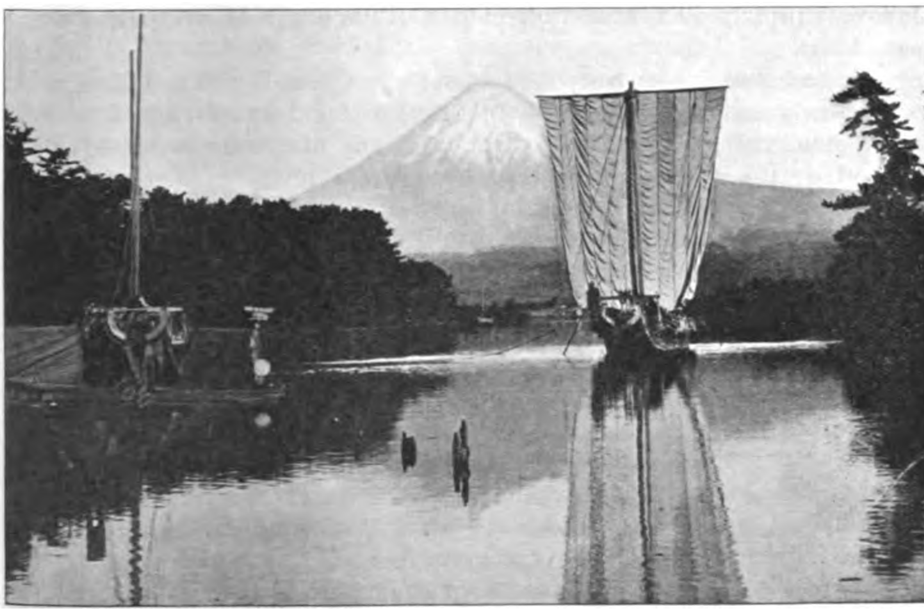

FIG. 1.—Fujiyama, the Sacred Mountain of Japan.

We left Kobe that afternoon, and the following day anchored off a small port—Shimidzu—to take on a cargo of tea (fig. 1). Here we got quite a good view of Fujiyama, the sacred mountain of Japan; unfortunately at this season it is not snow-capped and so lost much of its charm. The Japanese say that, if one has once seen Fujiyama, one will return to Japan again. We would have liked to climb the mountain—the inspiration of Japanese art—but there was no opportunity for this. Pilgrims climbing the mountains all intone a mystic formula: "May our six senses be pure and the weather on the honourable mountain be fair." While at Shimidzu it was interesting to see the tea plantations on the hillsides, the "terraces" reminding one of the Himalaya foothills and Kashmir.

Early next morning we arrived at Yokohama, and before going ashore

had again to satisfy the Japanese doctors and police. The ship had hardly tied up before there was an invasion of "box-wallahs," and one side of the promenade deck was given over to them. The goods displayed were very varied, from cheap toys to expensive silks. All the box-wallahs had passes, and the Captain assured us that the goods proffered were of the same quality and no dearer than similar wares procurable ashore.

Yokohama, which is one of the principal ports of Japan, was practically wiped out by the great earthquake, tidal wave and fire of 1923, when something like 150,000 people perished; indeed, Yokohama reminded one of the towns of the battle area of Northern France. It is marvellous how rapidly the place is being rebuilt and, with the wise instinct of their race, the Japanese rapidly set to work to reconstruct the docks so that trade would not suffer.

We had always been very keen to see the Great Buddha at Kamakura, and here was our opportunity, so, hiring a taxi, we set off to see the "Daibutsu." It is hard to say which is the most interesting—Buddha himself or the little toy country one drives through on the way to his serene remoteness. And what a fairyland that country is—little villages nestling in among woods, all beautifully clean and neat; smiling happy faces everywhere; sunshine—fields of lotus, enormous butterflies; ancient temples; hundreds of butterfly children, and old, old people who look as though they are carved out of brown wood. *En route* to Kamakura we paid a visit to the temple of Hanuman—the monkey god of "See no evil, Hear no evil, Speak no evil" fame—and here also saw a very interesting museum of old weapons and other curios. The colossal bronze image of the Great Buddha was cast in September A.D. 1252, and though much injured in a tidal wave in A.D. 1495 is in a state of excellent preservation and repair. It is about 50 feet in height, 98 feet in circumference; the length of the face is 8½ feet, of the eye 4 feet, of the ear 6½ feet, and of the nose 3 feet 8 inches; the breadth of the mouth is 4 feet 2½ inches; the length from knee to knee 36 feet; and the circumference of the thumb is over 3 feet. On the return journey an alternative route was followed, and we passed through some more extraordinarily pretty country. Part of our road lay along the sea front, and here we got a further impression of the appalling havoc wrought by the great earthquake.

As it was exceedingly hot the afternoon was devoted to "shut-eye," but the evening found us exploring the "Benten Dori," a street famous the world over for its curios, lacquer and silks. We regretted not seeing Tokyo—only a street car ride away from Yokohama—but it was very hot the next morning, and as we were sailing early in the afternoon, we decided against making the trip to the capital.

One leaves Japan with a longing to come again and see more of this "Land of the Rising Sun"—a country situated geographically at the cross-roads of world traffic, and intellectually at the cross-roads of two civilizations—a country, on the one hand, of picturesque quaintness, on the

other hand of a remodelled national life that embraces a great industrial development, an enlightened Government, and a remarkable educational movement.

Trans-Pacific.

The next part of our journey—the trans-Pacific voyage—was to last nine days and cover 4,283 nautical miles. Three days out from Japan the weather became much colder as we were now steaming almost due north, and one was glad to discard tropical kit for warmer clothes. The transition to colder weather was welcomed by everyone after the "stickiness" of China and Japan, and had a marked effect on the health and spirits of all the invalids, some of whom were able to enter into the milder shipboard games. As an example of what was done for our comfort and enjoyment of the voyage may be mentioned an excellent cinema performance given in the saloon one evening. A feature of Divine Service on this route which sounded unusual to British ears was the inclusion of the President of the United States in the prayer for H.M. the King.

The 16th of August was for us "meridian" or "Antipodes" Day, having reached the 180th meridian, which is arbitrarily taken as being where the sun rises. Here we gained a day, and so had to count two successive days as being Tuesday, the 16th, a contingency not provided for in my Letts's Diary! In this connexion readers of Rudyard Kipling will remember the story of John Hay (in "Life's Handicap") who hoped to prolong his life because the men of science had said, "If you go round the world in an easterly direction you gain a day."

We had now reached our "farthest north," being only some eighty miles south of the Aleutian Islands. The weather had grown much colder, dense banks of fog were encountered, the sea was dead calm and the sky, when seen, was the grey sky of an English winter. For two days we never saw the sun, and the ship's fog-horn was sounded every minute. For safety, "Canada-bound" traffic follows a course roughly 100 miles south of "Japan-bound" traffic, so that full steam ahead is maintained, but the fog-horn is sounded for additional safety in case any ocean-going trawler or other small vessel should be in the vicinity.

A very interesting hour was spent one morning in a visit to the engine-room, the "Chief" himself very kindly conducting us and pointing out and explaining the main features. Our previous experience of ships engine-rooms did not extend to an oil-burning vessel, so there was much that was new to be seen. The principle governing the use of oil is much the same as that which obtains in the ordinary "Primus" stove. Something like 6,500 tons of crude Californian oil are burned in the course of the round trip—Vancouver, Manila, Vancouver. Only those who have travelled on an oil-burner can really appreciate the comfort enjoyed from the use of this fuel—absence of grit or smoke and the avoidance of that dreadful bugbear, "coaling ship."

Vancouver.

On August 20 Vancouver Island was sighted, and now the weather had become pleasantly warm again and the fog belt left behind. Early next morning we tied up at Victoria, the capital city of British Columbia, situated at the southern end of Vancouver Island. Unfortunately we did not see anything of Victoria, the home of many retired "Service" people enjoying the wonderfully mild climate. Here the ship was joined by Major E. C. Beddowes, M.C., R.A.M.C., liaison Medical Officer at Vancouver, who had come down from Vancouver itself to meet us.

Vancouver, curiously enough, is situated not on Vancouver Island but on the mainland, and is a four hours' sail from Victoria across the beautiful Juan de Fuca Strait. Steaming towards Vancouver one sees away on the port bow the mouth of the mighty Fraser River, and in the far distance the coast line of the United States. Salmon abound in these waters, and a large industry in salmon tinning is carried on. The largest city of British Columbia, Vancouver is beautifully situated on Burrard Inlet, a long arm of the Pacific that forms a nearly landlocked and fully sheltered harbour, actually the second largest natural harbour in the world, giving first place to Sydney, Australia. Entering the harbour through the Narrows a wonderful panorama is unfolded—the beautiful Stanley Park on the right; the towering peaks of the Sleeping Beauty and the Twin Lions (6,500 feet) on the left, and the vast expanse of harbour before us.

The Canadian Customs officers board incoming steamers at Victoria and carry out their inspection duties before Vancouver is reached, so that no time is lost on disembarkation. Thanks to Major Beddowes everything was so arranged that we had not the slightest trouble with our baggage, and the Customs officers proved very obliging and helpful. Passengers' luggage containing dutiable articles destined for the United Kingdom can be sealed and "bonded" right across Canada, and only becomes accessible again when aboard the trans-Atlantic steamer—this arrangement saves all the trouble of having one's baggage overhauled by the Canadian Customs officials. These officials have to be very wide-awake in view of the attempts made to smuggle opium in from the Orient. We were told that, on occasions when smuggling of a large consignment of opium is suspected, Canadian Government aeroplanes accompany the steamer for a few miles to port, in order to "spot" if the opium was dropped overboard to be subsequently picked up by waiting boats. Our destination at Vancouver was the Shaughnessy Military Hospital, which is the local hospital of the Department for Canadian Soldiers' Civil Re-establishment—a department corresponding to our Ministry of Pensions. We had met and made friends with many Canadians during the war and knew them for a warm-hearted people, and nothing could have exceeded the warmth and kindliness of our reception. The Shaughnessy Hospital (at one time a school) is beautifully situated on Shaughnessy Heights, at the edge of the southern suburbs of

Vancouver. Equipped with a splendid operating theatre, the latest electrical therapeutic apparatus and everything that goes to the make-up of a first-class hospital, the establishment provides for the treatment of ex-Service men and also of members of the Militia. The staff had all served overseas during the war and were naturally very interested to hear our accounts of the Chinese "show." Something like 100 beds had been set aside for soldiers of the Imperial Service invalided from China, and a large hutted building had been erected to provide extra accommodation if required. The climate of Vancouver resembles closely that of southern England, and it was a delight to wake up each morning in the clear bracing atmosphere after the heat and humidity of Shanghai. Almost immediately the invalids, without exception, commenced to improve, and within a few days the change was most marked.

FIG. 2.

Vancouver, the fourth largest city in Canada, has recently been suffering from a trade depression, but there is every indication that the city is now on the eve of a great "boom." The volume of trans-Pacific export and import trade has made it a very important seaport, whilst the city has also immense lumbering, mining, agricultural, shipbuilding and manufacturing interests. Vancouver is the Canadian port of the Canadian-Australasian Royal Mail Line of Steamships, and this was the route used for conveying many of the Australian and New Zealand troops to Europe during the Great War. Across the harbour is the sharp profile of a magnificent mountain range; and with its imposing business section, its busy docks, its fine shopping streets, and its flower-garbed residential suburbs that have overflowed north across the inlet and south towards the Fraser River, Vancouver is one of the great metropolitan centres of Canada (fig. 2). To give but one instance of the improvements being effected is the building

of a new dock by the C.P.R. Co, which has just been completed at the cost of a million pounds. There is a large and distinct Oriental quarter, and the foreign population embraces some 10,000 Chinese, 5,000 Japanese, and 3,000 Hindus. The problem of such a large Asiatic population is indeed a serious one. Vancouver is a favourite city, for its mild climate, floral luxuriance and proximity to water make life there pleasant. There are many bathing beaches, parks, boulevards, good motor roads and short and long steamer trips. Stanley Park, a remarkable forest of almost primeval characteristics, is situated within the city limits and is almost surrounded by water. In the park is an excellent zoological garden where some fine specimens of Canadian bears were seen. In this park also are preserved some fine specimens of the original "totem" poles which stood at the entrance to an Indian village on this site when the first white settlers arrived. Those who have seen that excellent musical show "Rose Marie" will remember what a totem pole looks like. In Stanley Park is also situated English Bay, probably the most popular and patronized of the numerous beaches.

A wonderful panoramic view of the city, Stanley Park, and the harbour with the mountains beyond, was obtained from the roof garden of the C.P.R. Hotel, the tallest building in Vancouver.

There was no lack of opportunity for seeing the principal places of interest, as a number of residents very kindly placed their cars at our disposal and themselves drove us round. An interesting visit was paid, in company with one of the professors, to the new University of British Columbia. It is worth noting, perhaps, that English "Rugger" is played at this Varsity, and a good fight was put up against the last lot of "All Blacks," when the latter passed through Vancouver, following their victorious European tour. We had the honour of being made members of the University Club during our stay, and received a hearty welcome from its President and members.

A very pleasant and interesting evening was spent at a dinner given by the Military Institute, in honour of Lieutenant-General Sir Arthur Currie, who commanded the Canadian Corps in France. The Military Institute is a form of Military club, its members being composed of Militia and ex-Service officers. Here we met some very interesting people, including a Colonel of over 80 years of age, who, when first he came to Canada, was shipwrecked, and landed with but £5 in his pocket! He gave a graphic account of his various experiences over a long period of years, how he had worked at almost every job, and once, for five years, ran a newspaper of his own.

Another interesting experience was a trip to Grouse Mountain (4,250 feet)—this was made by motor bus, passing through glorious scenery. Crossing the eastern end of the harbour by a wonderful bridge—the Second Narrows Bridge—we soon were ascending the slopes of the mountain, along a road strongly reminiscent of the Murree-Srinagar. The mountain is

appropriately named, for many Canadian grouse were seen during the ascent, rather larger birds than our English variety. At the summit of the mountain is a delightful "log cabin tea house," and from here the view is superb. One looks down on Vancouver harbour with the city and suburbs beyond, laid out as though on a chequer board. In the further distance can be seen the Fraser River and the Straits of Georgia, with the State of Washington (U.S. territory) lying beyond. It was on Grouse Mountain that we first saw the Canadian "husky," or sleigh dog—a large, fierce-looking animal. The huskies were all chained up, as, apparently, they are not very friendly to anyone but their own masters, and are prone to fight among themselves, and would "eat up" smaller dogs. A small black bear was also seen, a playful little fellow, quite tame, and without fear of dogs or humans.

Trans-Canada.

Now began the long railway journey across Canada—five days and five nights in covering the 3,058 miles between Vancouver and Quebec.

There are two trains daily in the summer season, running eastward from Vancouver to Montreal, the "Trans-Canada Limited," and "The Imperial." The former is the faster of the two by some hours, and is mainly composed of sleeping cars, while the latter is more comprehensive in its make up. These trains are a revelation: ponderous locomotives (by the way, the driver and fireman are known as the "engineers"), and huge, all-steel coaches; the latter give one a comfortable feeling of security, for in the event of a collision or derailment there is not the dreadful telescoping that occurs with the usual match-boarded coach. The sleeping accommodation is most comfortable, particularly so if a lower berth is secured. The berths are arranged in pairs down each side of the car—an upper, reached by a ladder, and a lower. The upper berth shuts up into the roof in the day, and the lower becomes comfortable seats facing each other for day travel. Berths are screened off from the central vestibule by curtains which button across on the inside when one retires to bed. At either end of the car are toilet rooms for men and women (note, one always reads "men" for "gentlemen" in Canada) respectively. The toilet rooms are very comfortable, being fitted with a set of wash-basins (h. and c.), good mirrors and easy chairs, and they are, with the exception of the open end of the observation car, the only place on the train where smoking is permitted. Having been allotted a lower berth on the "Imperial," and, with our heavy baggage booked on in advance, we "pulled out" punctually at 9 p.m. on September 1, on the long journey across the Continent. If making this journey alone, it is well to strike up acquaintance with a fellow passenger, particularly if he occupies the berth above or below one's own. The occupier of the top berth proved to be a very interesting and companionable young American, en route to Paris as a member of the American Legion. We soon "became acquainted," as the Americans say, and found

that our respective outlooks on life in general were much the same. As he had travelled much in America he "knew the ropes" thoroughly, and was of great assistance throughout the journey. Like all American travellers, he carried his "Baedeker," and from this was making himself conversant with Paris in advance. He had been in England with the American troops during the War, but had seen little of the country, and was hoping to see much more before he returned to America.

Each sleeping-car had a "coloured" attendant, and I was informed that many of these were students of American Universities spending their vacation in this way. Before we pass on I must mention that the food in the dining-car was excellent—picturesque menu cards depicting bygone episodes in the history of Canada and the C.P.R. are a feature, and one orders *à la carte*. It is here that it is well to have a companion, because each portion of food ordered is sufficient for two persons, and so by combining an order economy is effected.

The process of getting to bed required considerable exercise of gymnastic ability. Having adjusted the aforementioned curtains and left one's shoes outside, the next step is to get one's clothes off while in the position of a miner working at a coal face. However, after the first attempt it is not difficult, and after a few bumps one becomes quite expert. Racks are provided for one's clothes, and electric light switches are placed conveniently. We thanked our stars, however, for a lower berth, and long after we had retired heard our companion aloft still struggling valiantly!

The first part of our journey was the most interesting, travelling through the Canadian Pacific Rockies, which interpose their giant bulk between the Prairies and the Pacific Coast. The Rockies form one of the most remarkable mountain regions of the world, are composed of some five ranges, and offer *en route* nearly 650 miles of magnificent scenery—snowy peaks, glaciers, rugged precipices, waterfalls, foaming torrents, canyons, and lakes like vast jewels set in the pine-clad mountains. Opening our eyes the first morning we looked out upon Kamloops Lake, a widening of the Thompson River, with the Tranquille Sanatorium upon the farther bank. Tranquille is ideally situated, and beds had been reserved in the sanatorium for tubercle cases invalided from Shanghai. A few miles further on we reached Kamloops, the chief town of the interior of British Columbia, with a population of 5,500. The town is over 100 years old, having originally been a Hudson's Bay post. It is the centre of a district engaged in ranching, mixed farming, gardening, fruit growing, mining and lumbering, and enjoys a most desirable climate. Still following the Thompson River we reached the Shuswap Lake, a beautiful stretch of water, with renowned trout fishing, and at Sicamous were halfway between Vancouver and Calgary. Twenty odd miles beyond Sicamous we reached Craigellachie, famous historically for the completion of the Canadian Pacific Railway. An obelisk beside the track commemorates this, and it was here, on November 7, 1885, that the rails from the East met the rails from the

West, and the long-cherished vision of a Canadian trans-Continental railway became a reality. The first through train from East to West left Montreal on June 28, 1886, and reached Port Moody—then the Pacific terminal of the road—on July 4.

We climbed steadily to pass through the Monashee mountain system, the most conspicuous peak being Mount Begbie (alt. 8,946 ft.). Eagle Pass, through which the railway crosses, appears to have been cut purposely for it, so deep and direct is it. Several lakes occur at short intervals, and in turn force the railway into the mountain sides. We now entered the beautiful Columbia River Valley and reached Revelstoke, a flourishing town with a population of 3,500. The Columbia Valley is surrounded by

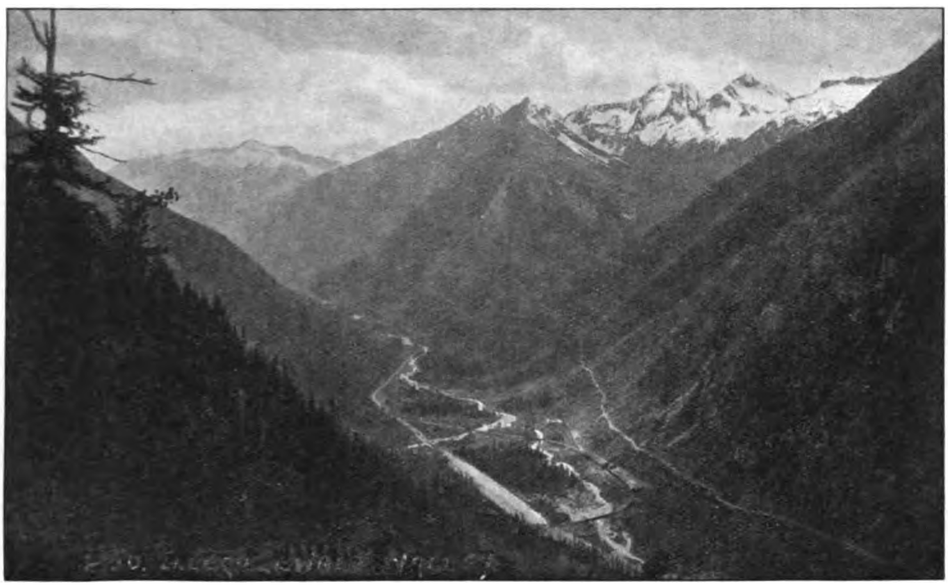

FIG. 3.

lofty and picturesque mountains, some clothed with trees and verdure to their very peaks, and others crowned with rugged and rocky spires of glistening glaciers. Revelstoke is in the heart of very fine hunting grounds, and in the winter a popular winter-sport Carnival is held there.

We had now reached the western end of the Selkirk range, and leaving Revelstoke, followed the Illecillewaet River up the valley of the same name (fig. 3). This is the home of the woodland or black-faced caribou, the mountain goat, and the grizzly, cinnamon and black bears. A halt is made to view Albert Canyon (fig. 4)—a deep fissure in the solid rock, its walls rising straight up on both sides to wooded crags. The railway runs along the very edge of this gorge and the river can be seen nearly 150 feet below, boiling angrily in a narrow 20-foot flume. It was interesting to note how

a river, such as the Illecillewaet, taking its course in a glacier, differs from an ordinary upland stream ; the latter, as it tumbles from great heights, may be foamy and tumultuous, but the water does not show that peculiar milk-green colour characteristic of a glacier-fed stream, due to its sediment of glacial silt. This silt is composed of infinitesimally fine particles ground from the rocks by scraping ice.

Reaching Glacier Station we were at an altitude of 3,778 feet and felt a distinct nip in the air. From here we got a wonderful view of Ross Peak and Mount Sir Donald, and leaving the station entered the Connaught Tunnel, which pierces the summit of the Selkirks. The tunnel was com-

Fig. 4.

pleted in 1916, and named in honour of H.R.H. the Duke of Connaught, then Governor-General of Canada. It is the longest tunnel in America, measuring slightly over five miles from portal to portal, and it not only eliminated track curvature to an amount corresponding to seven complete circles, but also lowered the summit attained by the railway by 552 feet, reduced the length of the line by 4½ miles and dispensed with 4½ miles of "snow sheds." (These latter, by the way, are an interesting feature, and two of them may be seen in the photograph of the Illecillewaet Valley). The tunnel is double tracked, and measures 29 feet from side to side and 21 feet from the base rail to the crown. The method by which it was pierced involved the tunnelling of a pioneer bore paralleling the centre line of the main tunnel—a feature that was new and aroused the interest of tunnel engineers the world over. Emerging from the tunnel one gets a

wonderful view of Mount Macdonald (9,482 feet), towering more than a mile in vertical height above the railway (fig. 5). A few miles further on we reached Stony Creek—a noisy mountain torrent, flowing in the bottom of a narrow V-shaped channel cut deeply into the steep slopes along which the railway creeps. The bridge which crosses the creek, 270 feet above the gorge, is the highest on the main line of the Canadian Pacific.

At Beavermouth, we again met our old friend the Columbia River, which with but one exception is the largest river on the west side of America. It is nearly 1,400 miles long, and drains a basin of nearly 300,000 square miles. The river is a route of history, by which some of

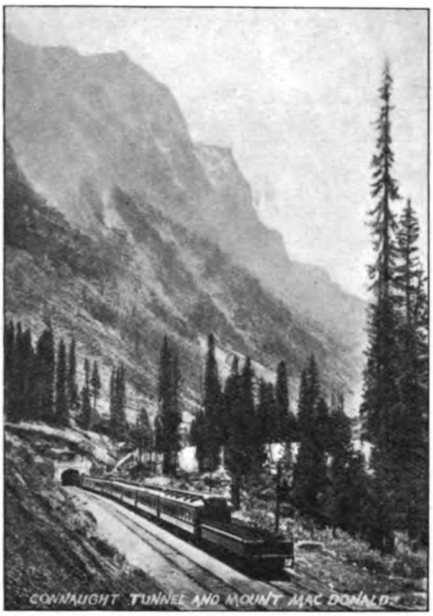

Fig. 5.

the earliest explorers reached the Pacific Ocean. Beaverbrook, at the base of the Selkirks, is the "farthest north" station of the trans-Continental line. Not only is the scenery hereabouts impressive, but the engineering feats are particularly remarkable, especially in the construction of bridges and tunnels. From one very high bridge, spanning a foaming cascade, is one of the most beautiful prospects of the whole journey. So impressed were the builders with the charm of this magnificent picture that they named the spot "The Surprise." Presently we passed the site of the oldest cabin in the mountains, the cabin where a Government survey party under Walter Moberly, C.E., engaged in preliminary surveying for the railway, passed the winter of 1871-72. A little further on is the model Swiss village of "Edelweiss," erected by the Canadian Pacific for the

Swiss guides whom it employs for the benefit of mountain climbers. Previous to the erection of this village, which lies on the slopes of a hill and reproduces with remarkable verisimilitude the characteristic architecture of a Swiss chalet, the guides had always returned to Switzerland at the end of each season, but now they live in Canada the entire year. At Golden we left the Selkirks and reached the western end of the Rockies, and it is here that the Kicking Horse River enters the Columbia. Proceeding up the Kicking Horse Canyon the scenery is superb and extraordinarily wild (fig. 6). The pass owes its name to an incident of

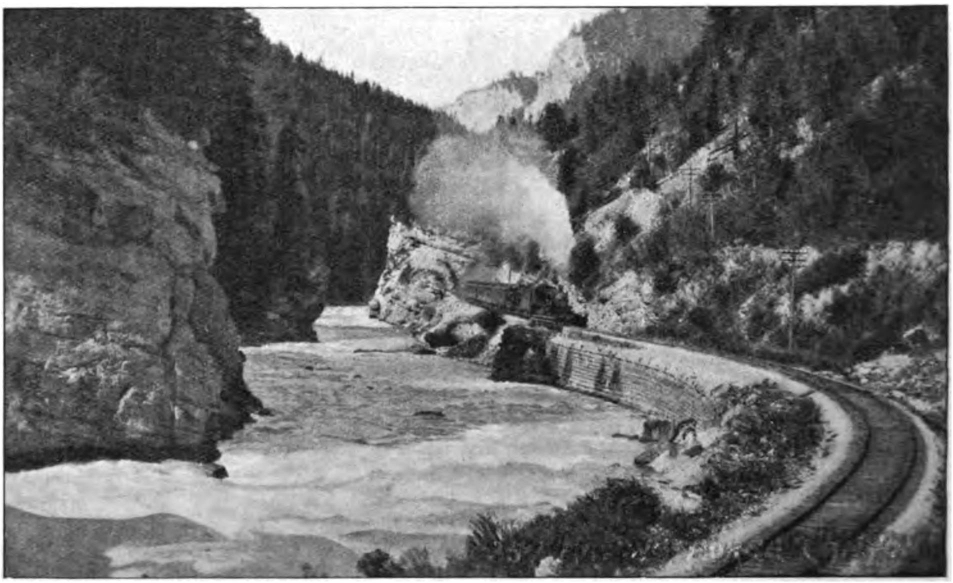

Fig. 6.

exploration days in which a kicking horse figured literally. In parts the canyon rapidly deepens until the mountain becomes vertical. The roar of the river as it rushes from side to side of the narrow gorge, the thunder of the train as it follows the river—pandemonium increased a thousandfold by the reverberations of the canyon walls—give an indescribable sensation. As we passed up the canyon we saw Mounts Vaux and Chancellor, the glacier on the former plainly visible; the latter (10,731 feet) is one of the giant peaks of the Ottertail Range.

(To be continued.)

Current Literature.

SUTHERLAND, I. N. **A New Method for the Practical Sterilisation of Milk Bottles.** *Med. Officer.* 1927, v. 38, 281-3, 2 figs. [1 ref.] [Usher Inst. of Pub. Health, Edin. Univ.]

A description of an experimental model designed to sterilize milk bottles with rapidity, efficiency and at a low cost. The plant is on the lines of the 'sack' disinfector, steam being admitted at the *top* of a steam-proof canvas

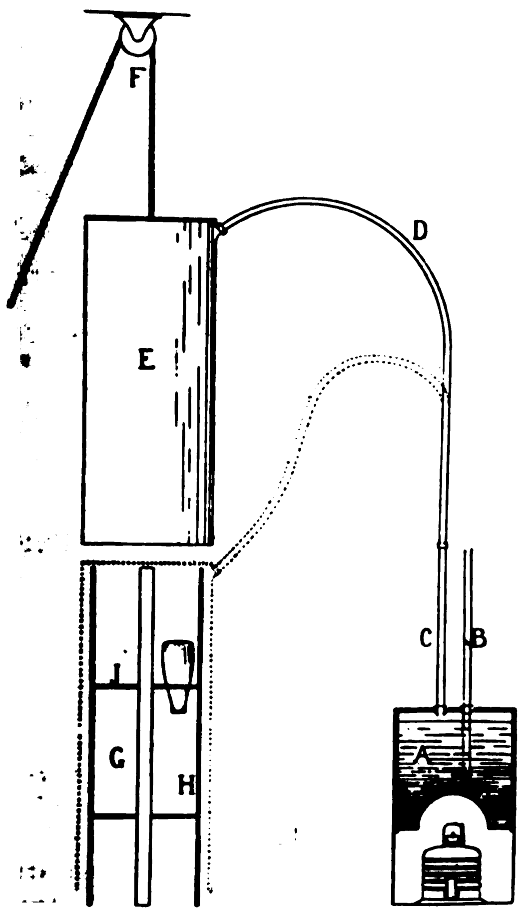

Diagram of apparatus, modelled on the well-known "sack" disinfector, for the sterilization of milk bottles. Dotted lines show the position of the steam container when lowered.
[Reproduced from the *Medical Officer*.]

container (E in diagram) which encloses the wooden stand (G), with circular trays pierced with round holes to support milk bottles in an inverted position. After the bottles are in position the container is lowered

into place over the stand and the steam introduced. In the diagram the steam is obtained from a high-pressure paraffin lamp, but any other source may be employed.

The author tested the efficiency of his apparatus by employing a large series of bacteria, both non-sporing and sporing and including the tubercle bacillus. The tests employed were intentionally very severe and amply demonstrate the efficiency of the sterilization obtained. Tubercle bacilli were killed with less than three minutes' exposure. Absolute sterili zation is not required and the author claims that 5 minutes heating is adequate to afford reasonable protection [a contention which his results strongly support].

Although that depicted is only a working model the apparatus could readily be adapted for ordinary economic use. The author claims for it small initial outlay and lessened working expenses, saving of time and space, and increased efficiency.

[This apparatus should be a valuable addition and help in the clean milk movement].

W. G. SAVAGE.

Reprinted from "Bulletin of Hygiene," Vol. 3, No. 5.

Reviews.

THE MEDICAL ANNUAL. Forty-sixth year. Bristol: John Wright and Sons, Ltd. London: Simpkin Marshall, Ltd. 1928. Pp. xcix + 630. Price 20s. net.

The editors have succeeded, as usual, in giving the reader much help in his search for what is new and promising, although they confess that they have been embarrassed by the large amount of such matter presented during the year.

To attempt to choose subjects for remark among such a wealth of good things is a difficult task, and we must content ourselves with a few words on some of the articles that impressed themselves on us in a glance through the volume ?

The liver treatment of pernicious anæmia has two articles devoted to it, as befits the latest discovery of importance in the treatment of disease. These give a good description of the rationale of the measure, and suitable details of its practice.

Much profit can be gained by a study of the article on epidemic encephalitis, which gives us, in full, what is known at present of this most difficult subject.

The tests for liver function are reviewed at length, and the conclusion is

drawn that the lævulose tolerance, bromsulphalein and icteric index tests are the most useful, especially in combination.

The reader will find the coloured plates that accompany the descriptions of the Shick and the Dick tests very helpful.

Preventive medicine is represented by articles on the reduction of infant mortality, ætiology of rheumatic fever, and the supervision and control of our food supply. The article on methods of dealing with epidemic disease in boarding schools will be very welcome to practitioners connected with such institutions.

On the surgical side there is an exposition of the modern indications for splenectomy that will repay reading, as will an article on sprains and synovitis. The surgeon will find much interest in the articles on pre- and post-operative treatment, operations on the hip and stomach and on genito-urinary surgery.

The section on venereal diseases gives prominence to the recent work at Woolwich in connexion with the treatment of gonorrhœa, and a most useful summary of the best line of treatment of an ordinary case of gonorrhœa and syphilis.

There is a special article devoted to the present position of radium therapy.

The many plates and figures are excellent; the reproduction of the various roentgenograms is particularly good.

The sections on pharmacy and appliances, and the lists of books of the year, medical institutions, etc., are useful.

Our description of the contents of the volume is of necessity entirely inadequate. Every practitioner should possess a copy and immerse himself in its wisdom.

The editors and publishers alike are to be congratulated on their success in maintaining the high standard of the work.

G. F. D.

PSYCHOLOGY AND THE SOLDIER. By F. C. Bartlett, M.A. Cambridge University Press. Pp. 221. Price 7s. 6d.

"Psychology and the Soldier," is a book in three parts. These are: "Choosing and Training the Recruit"; "Leadership, Discipline and *Morale*"; "Mental Disorders of Warfare." The author, who is Director of the Psychological Laboratory of the University of Cambridge, is well qualified to write on a subject that is bound up with war efficiency, having lectured on it for over six years; this book is a selection from his lectures.

In the service journals recently there have appeared articles on "Psychology in Relation to the Soldier." Attention is gradually being directed to this matter, and it is obvious that "a systematic attempt to understand the conditions of human activity" (as the author defines psychology) must soon be made by those whose duty it is to command and train troops. So Mr. Bartlett's book comes at an opportune time, and will

be welcomed by all who have imagination enough to realize the aid which the application of this rising science will lend to efficiency in the field. Many, from their own experience, may differ in opinion from the author on several points, but will be in agreement with him in his general treatment of the subject.

He considers that training in psychology should be made part of the general scheme of preparation for a military career; the soldier should study how human conduct is determined, and psychology might provide an interest for him that "is at once a relief from regular duties and an enormous aid to their satisfactory performance." There is a strong tendency at present, as already mentioned, towards developing the relationship between psychology and war, and one is glad to note the author's views that officers should be encouraged to set to work upon these problems. He has written a most interesting book, and his opinions merit close attention. He wants co-operation between the laboratory psychologist and the military officer who has a capacity for psychological work. For, as he writes, "any country which undertakes this matter seriously and with judgment will be taking a great step towards rendering its offensive and defensive services efficient in directions which, while they are of supreme importance, have been frequently neglected." M. B. H. R.

A SHORT ILLUSTRATED GUIDE TO THE ANOPHELINES OF TROPICAL AND SOUTH AFRICA. By Alwen M. Evans, M.Sc. University Press of Liverpool. 1927. Pp. 78. Price 9s. 6d. and (paper-covered) 7s. 6d.

This memoir, issued by the Liverpool School of Tropical Medicine, gives a collected account of the Ethiopian anophelines, and brings together the chief facts known regarding their habits and breeding places. Commencing with a step-by-step key, easy to follow and amplified by excellent illustrations, the author goes on to more detailed accounts of the systematics and bionomics of the various species, which are always clear, helpful and to the point. A most useful publication.

PHYSICAL DIAGNOSIS. By W. D. Ross, M.D. Fifth Edition. London: Henry Kimpton. Pp. 819. Price 42s.

This is a substantial and comprehensive work of some 800 pages in clear type and very liberally illustrated. To those who wish to possess a useful book for study or reference this work is recommended.

The substance matter is divided into four parts, relating in turn to the thorax, the abdomen, head, neck and extremities, and the examination of the nervous system. The clinical anatomy of both the thorax and abdomen is very fully described, and the student or practitioner should have no difficulty in grasping and memorizing the land-marks. The author then proceeds to demonstrate in an attractive manner the methods of examining by inspection, percussion, palpation and auscultation. Following this is a

concise description of the diseases of the bronchi, lungs, pleura and other thoracic and abdominal organs.

A pleasant feature of the book is found in the sections dealing with these various diseases, where we discover that the book deals with more than "physical diagnosis," for we find also the clinical pathology of the diseases under discussion briefly yet comprehensively placed before us, illustrated not only by reproductions of post-mortem specimens, but also of microscopical sections; some are in colour. The section dealing with the circulatory system includes polygraphy, sphygmomanometry and electrocardiography. Naturally, in a book of this size, lengthy explanations cannot be expected, but the reader will find therein the information he requires for all ordinary purposes.

Throughout the work many useful hints are to be found, and in the sections relating to the face, neck, hands, gait, and central nervous system, the reader will find much valuable and up-to-date matter to read and bear in mind. Much more could be said for this work, but if any criticism is necessary it might be suggested that many illustrations could be eliminated and perhaps replaced by more informative material. While agreeing with the author that profuse illustration is the nearest approach to personal contact in the teaching clinic, a picture to show how to apply the modern stethoscope to the chest wall seems a little unnecessary. Also a reproduction of a Potain's aspirator, with components duly lettered, but without any description, seems superfluous, for everyone must have seen the apparatus and know it by sight without necessarily having had occasion to use it. Other examples could be cited. The author has carried out his principle of leaving nothing to the imagination very thoroughly and successfully. The errors in type are few, and the book possesses an excellent index.

A Treatise on Hygiene and Public Health, with Special Reference to the Tropics. By Birendra Nath Ghosh, F.R.F.P. and S.Glas. Sixth Edition. Calcutta: Scientific Publishing Company. 1927. Pp. xv + 667. Price Rs. 6, or 10s.

As the title implies, this publication is written with special reference to the tropics, and as such fills a gap in the ordinary range of public health textbooks commonly available in this country. It is the hygiene and public health problems of India in particular that the author obviously has in mind. The book is divided into the usual chapters on water, air, food, etc., but a departure from the normal public health book is the introduction of chapters on tropical diseases and the life history of insect disease vectors. Naturally, such a large range of subjects cannot be dealt with very fully in a publication of this size, but all the information, which is often in tabular form, is concisely arranged. This, together with the inclusion of the chapters on tropical diseases and insect vectors, should make it a useful book for students preparing for examination for a D.T.M. and H. The present edition has been brought up to date by the

inclusion, in the chapter on water, of sections on such matters as the control of filters, the "taste" of chlorinated water and the use of chloramine; and in the chapter on disinfection a description of the Lelean sack, which we do not remember having seen in any publication apart from Army manuals.

Some of the author's explanations and descriptions appear to us to be somewhat confusing, such as the effects of impurities in water and the value and use of the deep trench latrine. We feel, also, that the pages devoted to practical chemistry in the chapter on water would be better omitted altogether, or, at any rate, should be relegated to an appendix in a book whose main theme is the principles and practice of hygiene. The volume, however, contains a great deal of useful information in a comparatively small compass, and is copiously illustrated by photographs and clear diagrams. G. D. J.

Correspondence.

A CASE OF SCURVY.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—That a case of scurvy should make its appearance amongst British troops serving at home under peace conditions is almost beyond credibility. This fact, and the circumstances under which this case arose, are my reasons for asking you to publish these notes so as to demonstrate how very necessary it is to include in our medical inspections of units every man present with his unit, irrespective of the nature of his employment therein.

In this respect a very wise and timely District Order was published on May 14, 1928, an extract of which is: "Attention is drawn, therefore, to the importance of ensuring that men employed on such indoor duties are present at periodical medical inspections. . . ."

On May 30, 1928 (sixteen days after the above order was published), a soldier from the troops in the area concerned was admitted to hospital, and the history of his illness, in his own words, is as follows:—

"For over two years I have been employed in the mobilization stores of the unit, and as far as I can remember it was soon after I took up this employment that I got tired of Army rations, as I had been bad with indigestion. So I applied and was allowed to come on ration allowance at seven shillings weekly, thinking I could live better and please myself what I ate. For my breakfast I used to have tea with bread and butter; for dinner, tea again with some kind of cooked meat, some days it was bovril, or eggs or cheese, potted meat, sardines, or anything that was handy. At supper time I had a couple of pints of beer and some bread and butter

or some bread and cheese. I got along all right and felt in my usual health until about a month ago (i.e., April 30) I noticed my teeth getting tender and my gums sore. As I couldn't chew I took to liquid food, such as tea, bovril, occasionally bread and butter. About a fortnight ago (i.e., May 15) I noticed some little red spots like pin-heads breaking out on my legs, but I took no notice till I felt my legs getting stiff and my left ankle started to swell and turn black. I still carried on my work, thinking it would go away again, but instead, it got worse, till I was forced to go sick, principally about my teeth, as I thought they were the cause of my illness, and it was my teeth I complained of to the doctor, and he sent me to hospital."

He was duly seen by the dental officer, and as several of his teeth were very loose, extraction of these was a matter of great ease.

On arrival in the medical ward he presented a typical clinical picture of scurvy. In his mouth one found the purple and swollen gums, while in between the teeth were soft swellings surmounted by multiple buds to form the so-called "blossoms." Present also were subcutaneous hæmorrhages over the regions of the ankles, behind the knees, on the front of the thighs, and on the front of the chest over the second right costo-chondral junction. Petechiæ of varying ages were well seen on the legs and around the hair follicles of the thighs. In addition to the hæmorrhages under the skin were intramuscular extravasations causing bulging of the muscles affected, and there was œdema round the tendo Achillis. There was no history of epistaxis, hæmaturia or melæna. Liver and spleen were not enlarged.

He was seen in consultation by an officer experienced in this type of disease, who agreed that the condition was one of typical scurvy.

The patient made a splendid recovery after receiving a diet rich not only in antiscorbutic vitamins but also one which contained plenty of the other known accessory food factors, and he returned to duty fit and well after a stay of just over a month in hospital.

I am, &c.,

M. B.

EDITORIAL NOTICES.

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Royal Army Medical Corps.

Original Communications.

MILITARY HYGIENE AND PATHOLOGY IN INDIA.

BY LIEUTENANT-COLONEL J. MACKENZIE, V.H.S.
Royal Army Medical Corps.

I.—THE HEALTH OF THE BRITISH TROOPS.

"IN former times, military medical statistics, such as they were, and when anyone could be induced to examine them, were, in effect, but a loose and barren record of mortality, leading to no practical result of any kind in favour of the British soldier, wherever he may have served. . . . . Whoever is conversant with the prevailing modes of conducting business in military offices must be aware that mortality alone is what executive officers of all ranks look to with most attention; almost, indeed, to the exclusion of other and most important concerns." (Sir Ranald Martin, 1868 [1].

Up to the middle of the nineteenth century Army medical officers dealt almost entirely with the care and treatment of the "sick and hurt.' Preventive medicine had no place in military administration.

At the close of the Peninsular War in 1814, a system of reports and returns was organized by Sir James McGrigor, first Director-General, and these were eventually consolidated at the War Office into volumes embracing all the details relating to sickness, mortality and invaliding. These reports for the first time called attention to the actual condition of the soldier as regards health, the adverse agencies by which he was affected, and the measures by which these could be ameliorated or removed [2].

In 1857 a Royal Commission was appointed to inquire into the sanitary

condition of the troops in England. As a result of its labours the "Queen's Hospital Regulations," published in 1859, for the first time instructed medical officers to advise commanding officers in all matters affecting the health of the troops, whether as regards garrisons, stations, camps and barracks, or diet, clothing, drill, duties, or exercises.

The first Annual Statistical Report on the Health of the Army was for the year 1859.

Thus military hygiene came into being.

Much water has run under the bridges since then. To-day the first duty of the medical services is no longer the care and treatment of the sick, but the prevention of disease and the maintenance of the troops in a robust state of health. An army exists to go to war, not to go to hospital. The efficiency of the medical services can be stated, to a large extent, in terms of inverse ratio to the number of sick it has to treat. The sick-rate is the measure of its success or failure.

The control of statistics is to the health officer what diagnosis is to the physician. The various diseases affecting a body of men correspond to the symptoms and physical signs of the individual patient. In both cases accurate definition and study of these are necessary before useful action can be taken and the necessary remedy applied. The health officer should have a strangle-hold on statistics.

Fortunately in the Army we can carry this principle into full effect. Each individual admitted to hospital is card-indexed; every out-patient is recorded. Notification is thus universal and absolute, leaving no gaps in our knowledge of what we have to deal with.

INDIA.

For the keen hygienist India provides a field of vast extent and absorbing interest. Here are to be found problems different from those of the United Kingdom and of many foreign stations—difficulties unknown in more settled lands: insect-borne diseases, undetermined maladies, and sudden death.

The earliest available statistics for the Army in India show that during the period 1800-1856, the average annual death-rate was 69 per 1,000 of strength. For the period 1817-1836 it was 71 per 1,000.

From 1838 to 1856, the average annual admission-rate was 1,968 per 1,000 and the death-rate (exclusive of men killed in action) 59 per 1,000. "Diseases of the liver" were the chief cause of mortality, while "diseases of the stomach and bowels" came next.

In 1859 no figures were available owing to post-Mutiny conditions. It is interesting to read that "the newly-established red serge frock was found to answer well as a substitute for the cloth tunic. The shako was no longer in wear, and the wicker helmet with white cotton cover was much approved of and in general use."

In May, 1859, a Royal Commission was appointed by Queen Victoria:—

(1) To inquire into the Rate of Sickness and Mortality and Invaliding among Our Troops in all stations throughout India and its Dependencies; and into the class of Diseases from which such Sickness and Mortality arise.

(2) To inquire into the Causes of such Sickness and Mortality, whether as relates to Climate, Locality, state of Barracks, Drainage, Water Supply, Diet, Drink, Dress, Duties, or Habits of Troops.

(3) To inquire into what Stations are unhealthy, and to indicate how such Unhealthiness can be removed, if possible, and the nature of the Sanitary Improvements required.

(4) To inquire into the subject of Healthy Positions generally . . . . also into the general subject of Sanitaria and Hill Stations, with the view of pointing out the most healthy positions on them.

(5) To inquire as to the best construction of Barracks, Huts, Hospitals and Tents for India.

(6) To inquire into the present Regulations or Practice for preserving the health of the Troops.

(7) To inquire into the present Organization of the Army Sanitary and Medical Service.

(8) To inquire as to the Practicability of establishing a general system of Military Statistics throughout India, and to ascertain whether any, and what Means exist, of comparing the Diseases and Mortality of the Troops with those of the Civil Population, English and Native.

(9) To Report what changes you may consider it expedient to make in the Present Practice, with respect to any of the Subjects above-mentioned.

The Commission, under the chairmanship of Lord Herbert, set about its task in thoroughly workmanlike fashion. Most striking are the clearness of vision and fixity of purpose with which it devoted itself to the wider question of the health of the troops rather than to the narrower and subsidiary problem of the efficiency of the hospitals. Its object throughout was the more truly military—and also more truly humanitarian—one of reducing the incidence of disease, without overlooking treatment and reduction of mortality amongst those who had already fallen sick.

Each station was investigated under the following headings and by means of an elaborate questionnaire as well as by inspection :—

(1) Topography.
(2) Climate.
(3) Sanitary condition of station.
(4) Health of the troops.
(5) Intemperance.
(6) Diet.
(7) Dress, accoutrements and duties.
(8) Instruction and recreation.

(9) Military prisons.
(10) Field service.
(11) Statistics of sickness and mortality.
(12) Hospitals.
(13) Burial of the dead.

Topography.—The topography of each station is described in detail.

Climate.—From the reports on the climate of stations we learn that the meteorological instruments consisted of "a barometer, thermometer and pluviometer," or "one thermometer and an aneroid barometer which is unserviceable; there is also a pluviometer," or, again, that there were no instruments at all. "Climate" was accepted as the great cause of sickness. Even where the incidence of fevers stood at a high figure and there was heavy mortality from "bowel complaints and diseases of the liver," a station is described as being "healthy, except for diseases due to climate."

Sanitary Condition.—The description of the sanitary condition of stations must often have been written with halting pen. "The present buildings have been condemned . . . . no drainage . . . . no means of washing or drying linen . . . . all the fluid refuse soaks into the subsoil where it falls . . . . a foul ditch surrounds the fort . . . . no stables for the mounted troops . . . . no quarters for married men, and the married people occupy barrack-rooms with the men, but separated by tatties."

"The bazar is an accumulation of huts without any attempt at order. The drainage is bad; the ventilation worse; water supply execrable. All the wells are brackish from nitre oozing into them from the surrounding earth, which is contaminated with all sorts of impurities, tanners' refuse included. Latrines are hardly known. In short the bazar is a mass of filth."

Health of the Troops.—In the station reports we read that "the troops suffer from intermittent fevers, dysentery and rheumatism." Hepatic disease was attributed to "exposure to heat and chills, cold stages of fever, intemperance and exposure to night air after the sequelæ of dysentery and fevers." "The diseases from which the troops suffer are—intermittent and remittent fevers, dysentery, cholera, small-pox and rheumatism."

"The nosological character of the more frequent zymotic diseases is miasmatic." "Common, continued and ephemeral fevers prevail to a great extent . . . . an obscurely remittent fever, with an adynamic character, often running into confirmed typhoid, prevails during and after the rains, and this was particularly observable at the time when asthenic dysentery prevailed, showing an apparent connexion in their ætiology."

In four years, out of the 10,423 European sick in one station, there were 2,038 venereal cases, being 42·9 per 1,000 of the strength.

Intemperance.—Among the station reports on intemperance we read: "The artillery soldiers are very intemperate. About ten per cent are

confirmed drunkards. . . . Spirits are sold in the canteen. An allowance of two drams of rum may be had at the canteen. Any amount of bazar spirits (arrack) is obtainable. . . . It would be beneficial to abolish the use and sale of spirits, but it is a measure that should be gradually introduced, for there are many confirmed dram drinkers who would not exist without it."

"Recruits often arrive in India with a positive distaste for spirits, but habit soon reconciles them to it, and in a few years the same man dies a confirmed drunkard through it." (It must have been a descendant of one of these whose admission to hospital in 1910 appears in the statistics as: "Dry mouth, 1.")

Diet.—In the section on diet we learn that, "the ration for Queen's British troops and European troops in the Indian army is the same, and consists of:—

Bread	1 lb.
Meat	1 ,,
Rice..	4 oz.
Sugar	$2\frac{1}{2}$,,
Tea	$\frac{5}{7}$,,
Salt..	1 ,,
Vegetables	1 lb.
Firewood	3 lb.

"A complete ration is provided for the troops, the stoppage for which is 3 annas and 4 pies (equal to 5d.) daily. The rations are cooked by native servants in copper boilers and in stew-pans."

Instruction and Recreation.—In many stations the men were confined to barracks throughout the day. "During the greater part of the day the men, if they please, can take exercise in the verandah of the barracks without injury to their health."

Military Prisons.—The less said about military prisons the better. Those days have passed.

Statistics of Sickness and Mortality.—Statistics seem to have been scanty and difficult to come by. "No information under this head" or "These could only be obtained at the office of the Presidency Inspector-General." In some stations, however, full statistical tables were obtained.

Hospitals.—Hospitals varied according to station. Some were large and roomy, with floor space of eighty square feet and over 1,000 cubic feet per patient. Others were little better than huts. In one station "the hospital was destroyed by fire a few months ago." In another, "the hospitals are not yet built, but a barrack is used as a temporary hospital. . . . . There are no shady walks or seats for convalescents."

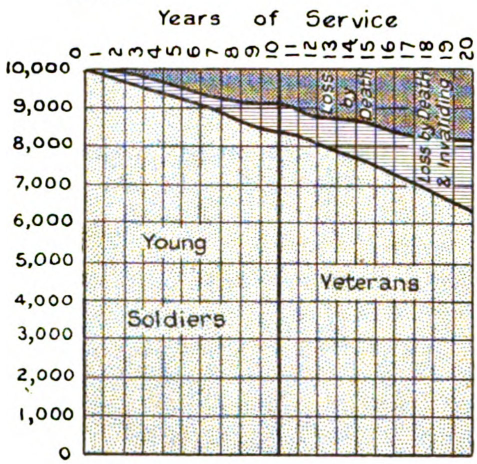
Burial of the Dead.—The arrangements for burial of the dead varied from station to station, e.g., "There are certain people who dig graves and prepare coffins for European dead, to whom notice is given by the hospital serjeant. . . . Two graves are always kept ready."

The Commission took four years, working at home and in India, to

collect evidence and complete its report. It brought together a mass of most interesting and valuable information, and exposed the unsatisfactory conditions under which the troops lived.

The following diagrams are reproduced from the Report :—

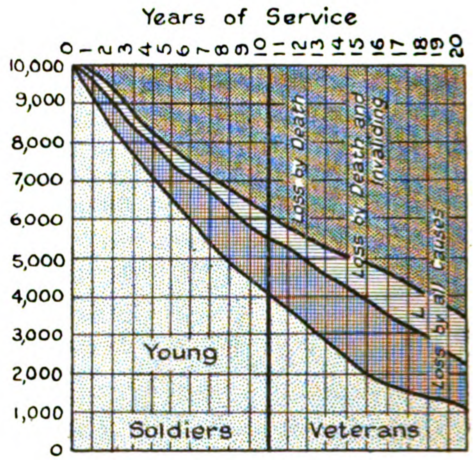
DIAGRAMS SHOWING THE LOSS IN THE ARMY AT HOME, AND IN THE EUROPEAN ARMY IN INDIA BY DEATH, BY DEATH AND INVALIDING, AND BY DEATH, INVALIDING AND ALL CAUSES.



HEALTHY ARMY

I

DIAGRAM I.—Representing the Army at home if the mortality were the same as it is in the male population of England at corresponding ages.



SICKLY ARMY IN INDIA

II

DIAGRAM II.—Representing the European Army in India.

Note.—The dark parts of the diagrams represent the areas of the graveyards filled by the two Armies in the same time under the assumed conditions.

The Force, 166,910, represented by the light area in Diagram I is assumed to be maintained by 10,000 annual recruits, which if there were no loss by death or by invaliding would sustain a Force of 200,000 men, represented by the whole of the square. The loss of strength shown in Diagram I is equal to 33,090 or 17 per cent; in Diagram II to 88,815 or 44 per cent, if no other loss were sustained than by death and invaliding. The dark area represents the loss of strength by death. The dark and single hatch areas represent the loss of strength by death and invaliding. The dark, single hatch and cross hatch areas in Diagram II represent the loss of strength by all causes. It will be borne in mind that many of the invalided die soon after leaving the Army.

Ten thousand annual recruits in Diagram I would sustain a force of 166,910. In Diagram II 10,000 annual recruits would sustain a Force of 111,185 if there were no loss from any other cause than death or invaliding.

Each of the 200 small parallelograms represents 1,000 men.

The Commission found that the great endemic diseases of India—which "injure the health or destroy the life of the British soldier"—were fevers, dysenteries, diseases of the liver and epidemic cholera; that compared with these all other diseases were of minor extent and importance; and that, apart from the question of humanity, the introduction of an efficient system of hygiene into India was of essential importance to the interests of the Empire. "The medical returns for some time appear to have included only the deaths in hospitals." And again—"Many of the

stations occupied by British troops are either within or close to cities and towns, the inhabitants of which are decimated periodically by fevers, cholera, diarrhœa and dysentery, connected with the most obvious local causes. The troops occupying this class of stations are exposed to any sanitary defects incident to the civil population, and suffer more or less from the same diseases. . . . The selection of new stations should be considered as one of the most important sanitary duties, and should be a recognized part of the sanitary service of the Army."

Florence Nightingale's observations on the evidence collected by the Commission, published as an Appendix to the Report in 1863, are a revelation of the conditions under which the troops lived—and died—in those days.

Among the recommendations of the Commission are the following :—

> "That the sanitary duties of medical officers, prescribed in the new medical regulations of October 7, 1859, be applied to all stations in India; and that properly trained army medical officers of health be appointed to this service at the larger stations.
>
> "That the system of army medical statistics at present in use at Home stations be extended to all stations in India."

The Annual Reports for succeeding years leave no doubt as to the value of the Commission's work.

In 1860 the hospital admission-rate was 2,000 per 1,000, and the death-rate 32·5 per 1,000, Bombay being the most healthy province, and Bengal (which then included the Punjab and the Central Provinces) the worst.

These figures refer only to the "Royal Army" serving in India, and do not include the European troops composing the army of the East India Company.

In 1861 Mian Meer (Lahore Cantonment) had the astounding death-rate of 352·75 per 1,000 (cholera); the death-rate at Amritsar, a few miles away, was 124·05 per 1,000. These were, and still are, highly malarious stations.

In 1862 some of the changes resulting from the incorporation of the Indian forces in the Queen's Army had been carried out, and the European officers numbered 3,962, while the N.C.O.'s and men totalled 70,489.

In 1865 the admission-rate had fallen to 1,505 and the death-rate to 28·14 per 1,000. Of the 94,209 admissions, 35,777, or 38 per cent, were for "Miasmatic Diseases."

In the Annual Report for that year it is stated that "the Royal Commission on the sanitary state of the Army of India gave the first impetus to sanitary improvement in this country." . . . "Good barracks for married soldiers—'patcherries' as they are called—where not already existing, are being provided everywhere, and in a short time the miserable, ill-ventilated one room heretofore allotted to each family will be replaced by two airy and comfortable rooms."

Under "lighting" it is remarked that "the insufficient light allowed

in the evening in barrack rooms is very generally dwelt on," with a footnote, "There is now authority given to light the barracks with kerosene oil."[1]

Statistical reports up to 1868 were compiled under the following quaint headings :—

Class I.

(1) Miasmatic diseases :—
  Eruptive fevers.
  Paroxysmal fevers.
  Continued fevers.
  Dysentery and diarrhœa.
  Spasmodic cholera.
  Sore throat and influenza
  Ophthalmia.
  Rheumatism.
(2) Enthetic diseases.
(3) Dietetic diseases.
(4) Parasitic diseases.

Class II.

(1) Diathetic diseases.
(2) Tubercular diseases.

Class III.

Diseases of the systems.

Class IV.

Diseases of nutrition.

Class V.

(1) Accidents.
(2) Battle.
(3) Homicide.
(4) Suicide.
(5) Execution.
(6) Corporal punishment.

At that time and for many years afterwards "paroxysmal fevers" were believed to result from decomposing vegetable matter entering the body in air or water; cholera was due to a *materies morbi* carried by the wind; dysentery was a malignant or "bloody" flux caused by improper food, impure air and exposure to cold and wet; typhoid fever was due to "a poison of animal origin."

In 1868 the Royal College of Physicians of London agreed to adopt a nomenclature and classification which had been prepared by a Committee

[1] Many of the British barracks in India are still lighted with the kerosene lamps of 1865.

of the College, assisted by representatives of the Medical Departments of the Navy and Army, the Registrar-General, and various other professional bodies.

The new nomenclature was adopted by the Army and came into force on January 1, 1869, for India as well as for the United Kingdom and the Colonies.

The ætiology of most tropical diseases was still entirely unknown. "Paroxysmal fevers" consisted of "ague" and "remittent fever," while dengue was included with small-pox, etc., amongst the "eruptive fevers."

In 1869 the admission-rate was 1,592 and the death-rate 37·15 per 1,000 of strength. "Malignant cholera and choleraic diarrhœa were much more prevalent and fatal than in 1868."

In the Report for 1881, it is stated that "paroxysmal fevers, cholera and sunstroke caused the excess of sickness and mortality." The P.M.O. Bombay Presidency considered that "in many of our barracks ventilation appears to be, as it were, overdone," and that "numerous cases of fever, bowel diseases and hepatitis are produced in this way."

In that year (1881) "the constitution of the hospitals was altered from a regimental to that of a general basis . . . at the end of the year all the hospitals were conducted on the general plan. Preceding this improvement, the hospital servants were formed into a corps of enlisted and trained men with much advantage in the way of efficiency, and at the same time reduction of one-third of their number. All the medical officers who notice the subject (*sic*) write approvingly of these alterations in the arrangements for the treatment of the sick."

In 1882, the increase in the "mean daily sick-rate" was explained by a change in the mode of preparing the returns on this subject, the figures being now taken from the admission and discharge books, instead of from the diet rolls as heretofore; in this way the duration of each admission is lengthened by one day.

The admission-rate of Fort Lahore was no less than 3,710·7 per 1,000, the highest in India, while its death-rate, 41·32 per 1,000, was the second highest; its admission-rate for "ague" alone was 2,471 per 1,000. Among the next highest admission-rates were Delhi and Mian Mir (Lahore Cantonment), malarial fevers being the cause.

Enteric fevers were very prevalent, and largely accounted for the high death-rate, 12·82 per 1,000.

"Scurvy prevails among the men to a degree respecting which the returns give no notion; the vegetables used have but little anti-scorbutic effect; the meat is underfed, tasteless, poorly-nourishing."

Regimental institutes were established during this year (1882).

In the Annual Report for 1887, the P.M.O., Bengal, refers to "the satisfactory state of the general health of the troops, as evidenced by the statistics of sickness and mortality." (The admission-rate was then 1,403·8 and the death-rate 15 per 1,000). "The sanitary conditions of the barracks

and their immediate surroundings were generally good; no known cause of disease existed, and the causes of enteric fever, which is now so widespread and is so fruitful a cause of mortality and inefficiency (538 admissions and 166 deaths in Bengal alone) are believed rarely to be found in or about the men's dwellings, but rather in the insanitary bazars and places to which the men resort."

"With a view of teaching men to cook their meals instead of being dependent on the services of native cooks, it has been arranged that during each cold season a certain number of men in each company should be formed into a class for instruction in preparing and cooking rations."

The P.M.O. of the Bombay Command recommended that the floors of barracks and hospitals "should be made of some non-absorbent material, impervious to water as well as gases, so that they might be flushed and washed from time to time, without danger of any germs of infection being left behind."

In 1890, influenza prevailed extensively in India. Mention is made of "the practice which has crept in of wearing khaki drill in the cold season for marching, musketry, field days, etc. . . . . it may render the soldier more liable to climatic disease; the colour is most suitable, but serge would be a preferable material." At one station, "the officer commanding the infantry regiment took much trouble to supply each of his men with fresh vegetables daily, free of charge, and also kept a number of cows to provide milk at a reasonable rate for the use of the soldiers and their families." At another "precautions are adopted to allow none but the water authorized for drinking and cooking to be conveyed in the mussacks specially set apart for that purpose."

In 1891, the prevailing diseases were:—

	Admissions	Deaths
Malaria	23,256 ..	40
Venereal diseases	21,005 ..	6
Simple continued fever ..	2,334 ..	1
Enteric fever	1,343 ..	380
Cholera	251 ..	167

As examples of the high admission-rates of those days the following are of interest:—

Barrackpore	2,392·4 per 1,000	(ague)
Saugor	2,195·4 ,, ,,	(V.D.)
Campbellpore	2,054·2 ,, ,,	(V.D.)
Dum Dum..	2,020·0 ,, ,,	(Malaria and V.D.)

At Campbellpore, simple continued fever caused a good many admissions "due to the heat of the summer."

At Naini Tal, locusts fell in large numbers into the lake in August; water for drinking purposes was then obtained temporarily from the spring at the head of the lake.

The highest death-rate was 44 per 1,000 at Allahabad (29 out of 45 deaths were from cholera).

Enteric fever was very prevalent in 1897, and many pages of the Report are given up to this disease, the opinions as to its causation being many and varied. One medical officer attributes the majority of cases to "infection from the soil of rest-camps or from the floors of the cook-houses," while in several cases the "enteric microbe" is reported as "having been found in the drinking water."

In 1896, the disease groups giving the highest admission-rates were :—

	Actuals	Rate per 1,000
Venereal diseases	31,325 ..	444·4
Malarial fevers	17,825 ..	252·9

The question of antityphoid inoculation by an expert had been recommended and was being discussed.

In 1897, venereal diseases accounted for one one-third, and malarial fevers for nearly one-fourth of the total admissions.

In 1898, the "Army Medical Staff" became the Royal Army Medical Corps.

We now come to a most interesting stage in the medical history of the British troops in India.

The annual admission-rate—but for one exceptional year—had never been lower than 1,300; the highest rate—also exceptional—was 2,000 in 1860; the usual fluctuation, since 1875, was between 1,300 and 1,500, while the average was 1,466 per 1,000.

In 1898 the admission-rate was 1,423·7, i.e., about average.

In 1899 there occurred a sudden and permanent fall—to 1,148·7 per 1,000, a ratio which has never, since that time, been exceeded or even approached.

What were the causes which, acting suddenly and with permanent effect in 1899, brought down the admission-rate to a figure far below any previously recorded?

In 1898 there were	95,103 admissions	with	1,272 deaths
In 1899 ,, ,,	77,765 ,,	,,	863 ,,
Decrease ..	17,338 admissions	and	409 deaths

This remarkable fall is accounted for almost entirely under four disease groups :—

	Admissions 1898		Admissions 1899		Decrease
(1) Malaria	28,382	..	16,579	..	11,803
(2) Venereal diseases	19,847	..	16,946	..	2,901
(3) Diseases of the digestive system..	8,408	..	7,495	..	913
(4) Enteric fevers	2,375	..	1,392	..	983
Totals ..	59,012		42,412		16,600

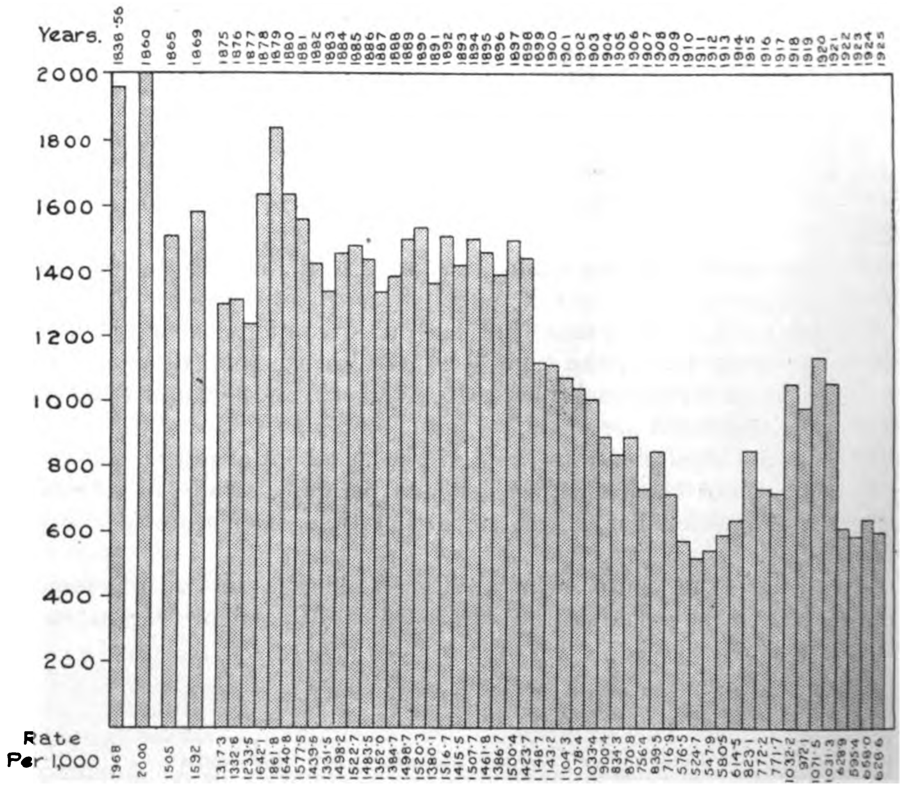
It will be noticed that these four disease groups together caused more than half the total admissions to hospital in both years.

Malarial incidence is subject to wide fluctuations dependent on the

monsoon, and 1899 may have been a remarkably favourable year in this respect. The incidence in 1900 rose again by several thousands.

Venereal disease is on a different footing, and presented then, as it does now, one of the greatest problems of military hygiene. Special attention had been given to it, and the Report for 1897 contains the following statement: "The introduction of the new cantonment rules will,

DIAGRAM III.—ADMISSIONS—ALL CAUSES, BRITISH TROOPS, 1838-1925.



it is anticipated, check the ravages of venereal disease." At this time lock hospitals for women or "cantonment hospitals," as they were called, were being more widely established as part of the campaign to reduce venereal disease. It is difficult to resist the conclusion that the sudden improvement of 1899 was associated, to some extent at least, with the new measures adopted in 1897.

Diseases of the digestive system—chiefly liver troubles—undoubtedly in those days included many cases of malaria; "hepatitis" was a useful heading under which to include many doubtful cases. The fall in this group need not therefore be taken as of special import.

Enteric fevers, as we have seen, had been a cause of great anxiety for

some years. The figures kept mounting up, the deaths grew year by year. Yet, in 1899, there was this sudden drop from 2,375, to 1,392 cases. Nothing in the Report itself for that year gives any clue to the cause of this phenomenon, but in an Appendix we find "tables showing the result of preventive inoculations against enteric fever during the year 1899." From these it appears that antityphoid inoculation was carried out in 60 units, 4,502 men being inoculated out of a total all-India strength of 67,697.

Analysis of the results yields the following :—

	Inoculated	Non-inoculated	Proportion
	4,502	63,195	1 to 14
Cases	44	1,248	1 to 28
Deaths	9	339	1 to 38

Remarks by the P.M.O. in India follow the tables: "The results obtained are very favourable, and would have been more so had second inoculation been always practised, but many of the men appear to be prejudiced against the operation, and it is reported from some stations that few would submit themselves for the second inoculation. The cases of enteric fever which occurred amongst the inoculated men were in the majority of instances of a mild character."

The fall in the admission-rate of 1899 may therefore be explained, in some measure at least, by: (1) A favourable monsoon and a growing knowledge of malarial ætiology; (2) the introduction of new cantonment rules and of lock hospitals for women (cantonment hospitals); (3) antityphoid inoculation; (4) the growing habit of "detaining" men for a few days instead of "admitting" them to hospital.

The improvement is, therefore, partly apparent and partly real.

In 1900 the Pasteur Institute of India was established at Kasauli, the first Director being Major D. Semple, R.A.M.C.

In that year, and in each of the following years, there was a slight progressive fall in the admission-rate, until the figure reached 1,033·4 in 1903. It must be borne in mind that there were no statistics of men treated as out-patients or "detained" in hospital; we are not in a position to check the admissions to hospital against the admissions to barrack treatment, so as to define accurately the total disease incidence.

In 1904 the admission-rate fell to a new record, viz., 900 per 1,000. The chief causes of sickness were, as usual, malarial fevers and venereal diseases, which together caused 41·12 per cent of the admissions for all causes. This year, for the first time, the number of cases treated in barracks is given, viz., 22,438. It is certain that part of the decrease in admissions to hospital is accounted for by the extended use of barrack treatment. Enteric fevers were still very prevalent—1,384 cases with 265 deaths; segregation of convalescents was organized, and drafts from home were also isolated for several weeks on arrival. Inoculation with an improved vaccine was practised to a limited extent, with very promising results.

The Report on the health of the troops for 1910 was the most favourable recorded up to that time and showed a real and very marked improvement on the preceding years.

The admission-rate fell to 576·5, a reduction of 140·4 per 1,000 as compared with 1909, while the death-rate fell to the record figure of 4·66 per 1,000.

The most important *decreases* were enteric fevers 343 cases, influenza 460, dysentery 243, malaria 4,939, pyrexia of uncertain origin 1,663, venereal diseases 582, and small-pox 16. At the same time the cases treated in barracks fell by 2,161.

In 1911 there was a very small increase in the death-rate, chiefly due to cholera (twenty-one deaths) and plague (six deaths). The admission-rate, however, fell to 524·7, *the lowest figure ever recorded before or since.* Malaria, enteric fevers and venereal diseases all gave lower ratios than in the preceding years.

It is not perhaps necessary to discuss in detail the causes of this very satisfactory improvement. Preventive medicine had by this time acquired a comparatively firm grasp of the ætiology of tropical diseases; anti-typhoid inoculation was in full swing; sanitary training and discipline were at a high level throughout the Army. The opening of the Royal Army Medical College in London in 1902 had given a great fillip to preventive medicine in the Army. Firth and Horrocks in hygiene, Wright and Leishman in pathology, were teachers who enthused and stimulated all who passed through their lecture-rooms and laboratories. New energy was infused into the medical services, new ideals were established, and there was a general stimulation of effort. Regimental officers also had become keen sanitarians.

Whatever the cause, it is a fact that the year 1911 was the healthiest year that the British Army in India has ever had.

During each of the three following years prior to the Great War the admission-rate showed a tendency to rise, and in 1914 stood at 614·5.

For six years during and after the war the admission-rate kept up in the region of 800 to 1,000 per 1,000. The effects of the war remained in the form of: (1) a lower general standard of physique amongst the men; (2) a general lowering of sanitary training and knowledge throughout the Army.

It was not until 1922 that the situation returned to something approaching normality. In that year the admission-rate fell from 1,031·3 to 628·9 per 1,000 and has remained at about that level ever since.

An analysis of the statistics for 1924 produces the following :—

Average Annual Strength: 58,614.

	Actuals	Per 1,000
Admissions to hospital	38,569	658·0
Average number constantly sick in hospital	1,857·95	31·7
Deaths	246	4·2

A comparison with the troops serving at Home in 1924 is as follows:—

	Average strength	Ratio per 1,000 of strength					Average sick time to each soldier (days)	Average duration of each case of sickness (days)
		Ad-missions	Deaths	Invalids: Sent home	Invalids: Finally discharged	Constantly sick		
At Home..	101,698	362·8	2·00	—	13·49	21·12	7·73	21·32
India ..	58,614	658·0	4·27	15·00	14·74	31·7	11·97	18·18

The principal diseases or most serious "symptoms" of the British Army in India in that year were:—

(1) Diseases caused by biting insects (mosquitoes and sandflies), viz.—		
Malaria	12,120	
Sandfly fever	2,042	
Dengue	1,005 ..	15,167
(2) Venereal diseases		4,037
(3) Cellulitis, abscesses, etc.		1,870
(4) Dysentery, colitis and diarrhœa		1,717
(5) Tonsillitis and pharyngitis		1,493
(6) Bronchitis, pneumonia and pleurisy		1,492

The first group under which the official records are compiled in accordance with the nomenclature of diseases is "Diseases due to infection." These totalled 20,586.

If we add tonsillitis, colitis, enteritis, abscess of liver, animal parasites, and other diseases of an infectious or communicable nature which are shown under the various "systems," the total becomes roughly 25,000, or about two-thirds of the admissions for all causes.

The position in 1924 may therefore be set forth as follows:—

Average strength of British troops		58,614
Of which 65·8 per cent. were admitted to hospital		38,569
,, ,, two-thirds were communicable and infectious diseases		25,000
,, ,, three-fifths were caused by biting insects		15,167
Of which:—		
Malaria (mosquitoes) represented	12,120	
Dengue (mosquitoes) ,, ...	1,005	
Sandfly fever (sandflies) ,, ...	2,042	

Diseases caused by biting insects are therefore the most important problem that military hygiene in India has to deal with and the first and foremost of all is malaria.

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(To be continued.)

"MAJORS R.A.M.C. FOR PROMOTION TO THE RANK OF LIEUTENANT-COLONEL."

"PART II. (PRACTICAL.)"

APPRECIATIONS.

By LIEUTENANT-COLONEL D. S. SKELTON, D.S.O.
Royal Army Medical Corps.

IN the title for this paper there is one word in which I ask those who are patient enough to read on to take a real interest, and that is the word PRACTICAL. Yet, for all its importance, King's Regulations put the word in brackets; but, for my purpose, I should like the word to be imprinted on the mind of the reader in large type. An apology is very much needed for adding to the already copious literature on promotion examinations. The bibliography on the subject is almost enormous. My only excuse is, experience suggests, and conversation in mess and elsewhere confirms, that a proportion of majors due for promotion to the higher rank do rather funk one or two features of the examination. One is also reminded of the fact that, as it is now some ten years since any of us had the opportunity of putting our theoretical knowledge into practice, officers now coming up do not, as a rule, have that advantage of experience in the field as, say, D.A.D.M.S., or O.C. field ambulance, which their more senior colleagues had. This, I feel, is a handicap, as the examiners will all of them have had the experience which examinees will have lacked, and that being so, any deviation from the essentially practical which may be disclosed by the candidate is instinctively "used in evidence against" him by the examiner. The purport or "object," then (as Training and Manœuvre Regulations call it), of this paper is to try and emphasize the importance of the practical side of the problems that will be presented to the candidate, and next, after having been intolerably iconoclastic, to make some attempt at erecting an edifice on simpler architectural lines.

Every one of us who has had to do it cannot, I think, but admit that the art of writing a medical appreciation to suit every type of reader or critic is a difficult problem. Nevertheless, in that rather elastic and, at times, ambiguous phrase, there is implied nothing more than asking a specialist to "size up" matters which come within his special knowledge. As to its form. Training and Manœuvre Regulations say, "so long as the reasoning is logical and leads up to a definite plan the actual form of an appreciation is of minor importance." Therefore, that slavish adherence to type which is not uncharacteristic of the work of a proportion of candidates should, I think, be avoided. In the literature I have referred to there will be found articles by senior and experienced officers of the

Corps, who have carefully, and perhaps rather elaborately, marshalled a number of points which, it is admitted, must always be kept in mind when writing or framing the appreciation; but I cannot persuade myself that any of these distinguished officers ever thought their "types" would be used as a kind of *pro forma* in a practical examination. And yet this frequently happens.

I am an AMY-ITE; that is, I believe very largely in those excellent principles suggested by Major Amy in a recent article in this Journal. For example, he mentions the classic instance of the candidate who handed in his nineteen pages of typed foolscap. The causes of this *cacoethes* I think are: (1) The resonance of the important names that have headed the *pro forma* papers, and whose reverberation has led some candidates into believing that this is the only way in which their paper is to be served up to the unfortunate examiners; or, in its really practical application, to the staff; and (2) to a complete inability on the part of some men, common to all ranks and walks of life, to see the wood for the trees. "So putting," as says Haji Baba, "the tongue of opportunity into the cheek of discretion," I should like to support Major Amy's advice that "staff articles" in the Journal must be read with caution and discrimination. I think I may be able to indicate to some extent, in tabular form, what I mean by this and to show how invisible was the undergrowth in a certain forest during a recent examination.

In this instance, shortly, the military situation was historically that of the Allies *v.* the Central Powers, in March, 1918, with perhaps especial reference to the position of the Fifth Army. The enemy was expected to take the offensive on a large scale early in 1928, in order to win a decisive victory before the troops of a fresh belligerent could arrive in large numbers.

The factors given in the narrative, which in this case is the equivalent of the G.S. Memorandum, were very comprehensive and included full information as to the position of the entrenched line, the political situation, the enemy's apparent plans, our own strength, order of battle, bases, ports, etc., in fact everything you could want to know.

An appreciation of the situation was called for from THE MEDICAL point of view as D.M.S.

The table on page 258 is an analysis of the papers handed in.

Now surely this is an interesting state of affairs. Here we have several officers working out the practical part of a scheme. An historic military situation is put before them. They are asked to let the G.O.C. know how they propose to meet the special difficulties that will arise, difficulties, that is, which concern them as specialists, and to advise him as to measures essential to overcome them. As Major Amy says, the G.O.C. will probably be a more or less harassed man with almost every minute of the day mapped out, and it is not likely that he will be able to give his D.M.S. a very extended interview; and yet, when the interview is accorded,

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the D.M.S. proposes to discuss a proposition with some thirty-seven or more main points and a few subheads. As Major Amy thinks, there would only just be time afterwards for the D.M.S. to catch the afternoon train for the beach preparatory to buying his bowler hat.

	Candidate No.						
	1	2	3	4	5	6	7
Pages of typed foolscap per candidate	9	11	8	5	8	6	9
Strength of force	+	+	+	+	+	+	+
State of equipment of force	+	+	—	—	—	+	+
Length of time at war	+	+	+	+	—	+	—
Trench positions	+	+	+	—	—	+	—
Enemy plans	+	+	+	+	+	+	+
Type of warfare going on	—	—	—	—	+	—	—
Base and other ports, situation of	+	+	+	—	—	+	+
Advanced base, situation of	+	+	—	—	—	—	+
Scale of W.E. medical units	—	—	+	—	—	+	—
Corps positions	+	+	—	—	—	—	—
Railways and roads	+	+	+	—	+	—	+
Naval situation	—	+	—	—	—	+	—
Allied plan of campaign	+	+	+	—	—	—	—
Intercommunication (signals)	—	+	—	—	—	—	—
Scale of existing medical arrangements	+	—	—	—	—	+	+
Topographical factors	+	—	+	+	+	+	+
Morale of Allies	—	+	+	+	—	+	+
Climate	+	+	—	+	+	+	+
Health of civil population	—	+	+	+	+	+	+
Local supplies (coal)	—	+	—	—	—	—	—
Essay on man-power	—	+	+	+	—	—	—
Prevalent diseases of Allies	+	+	+	+	+	+	+
Classes of wounds likely	+	+	+	+	+	+	+
Gas and civil population	—	—	—	—	—	+	+
Estimate of sick, with formula	+	+	+	+	+	+	+
,, wounded ,,	+	+	+	+	+	+	+
Sick and wounded, full details	+	+	+	+	+	+	+
Evacuation factors	—	+	+	+	+	—	+
Beds necessary	+	+	+	+	+	+	+
Red Cross activities	—	—	+	+	+	+	+
Consultants	+	+	+	+	—	+	—
Number of hospital ships necessary	+	+	—	—	+	+	+
Measures, preservation health of troops	+	+	+	+	+	—	+
"Surgical teams"	—	—	—	—	—	—	+
"Primary suture," details of	—	—	—	—	—	—	+
Distribution of medical units	+	+	—	+	+	+	+
State of medical equipment	+	+	+	+	+	—	+
State of ordnance equipment	+	+	—	+	+	—	+
Summary, pages of type	⅓	½	0	0	0	½	½

+ indicates mentioned.
— indicates not touched on.

Thirty-seven points! Think of it! Wilson tried to settle the fate of a world with fourteen, and is not the whole of a dogma determined in thirty-nine? Again, I have a recollection that in the first volume of "The World Crisis" the naval situation on the outbreak of war was appreciated by Winston Churchill on a small sheet of Admiralty note-paper. There is a photograph of it in the book. To my mind it is a model appreciation, for

it is clear, concise and complete; the key essentials. I cannot but conclude that the G.O.C., even in his less harassed moments, would turn to the summaries.

Thirty-seven points! Let me analyse them a little further. To elaborate them the average number of pages of foolscap typed was eight per candidate; number of points already well known to The Chief, say twenty; number of points Chief does not want to know, say six. In other words, about two-thirds of the matter in the instance I have quoted could have been cut out; five pages of MS. may go into the waste-paper basket, leaving three to go in and meet the General, and I am not sure that that is not one page too many. I do not in the least mean to imply that all of the thirty-seven, and a multitude of other factors, should not have been submitted to careful thought and full consideration before the appreciation could have been arrived at, but for everyone's sake one is entitled to ask that the typist, the typewriter, and even economy in foolscap may not be overlooked. And as Stephen McKenna says, "a summary, if short enough, is fatal to any work of imagination."

Destructive criticism seldom presents any very great difficulty, and it is with considerable diffidence that I venture to put forward suggestions for rebuilding. But the site is the same and the materials unaltered, yet I want the style of my building to be simpler. I should like to examine my plans from the angle of "the occasion and the point of view," and to lead up, once more, to the question of those broad principles on which so much already has been written. If we consider some examples of the occasions on which an appreciation may be called for, it will, I suggest, be apparent that anything in the nature of a cut-and-dried way of framing it is inapplicable, and further, it must be borne in mind, an appreciation to be of any real good, whether it be a combatant or a medical one, must be such that a staff officer, other than the writer, can act on it or write orders from it. The variations are enormous. There is, for example, the occasion when an O.C. field ambulance meets one of his junior officers up in the line and asks him how he is getting on. The latter rapidly appreciates the situation and replies, "Fairly well, thank you, sir; but it's a pretty hot corner down by Snook's Farm. If I had a few more bearers we'd get the place cleared a bit more quickly." Result, possibly a few more bearer squads arrive from somewhere, or cars are run up closer.

At the other end of the scale is "the big business," requiring the highly-trained, experienced brain of a man, who must be almost a genius to elaborate the perfect organization which is to stand the test of the gigantic operations of modern war. And between the two are all the gradations of responsibility: A.D.M.S. of a divisional area, lines of communication or base; D.D.M.S. of a corps, lines of communication, base, etc. Occasions, again, can be divided into two great groups:—

(*a*) In peace, implicating plans of campaign in almost any and every part of the world under enormously varying conditions.

(*b*) In war :—

(1) Previous to embarkation. Surely here, if ever, is scope for a full-dress essay, and imagination may roam from mud to morale, or head-dress to harvest time.

(2) On disembarkation. The issue narrows considerably. A new set of problems has arisen; but you have your notes on the Winstonian half-sheet of note-paper, and it only remains to use them.

(3) Preparatory to: (*a*) Attack; (*b*) a rapid advance; (*c*) the possibility of a forced retirement. Still narrower; still fewer the points necessary, I think, to emphasize to the staff; but a multitude of technical ones that will have to be presented to your technical subordinates.

(4) During static warfare. Means hard thinking, but is unexciting.

(5) On re-embarkation.

(6) On demobilization.

By this time, as D.M.S., you would have collected such a perfect staff that you will probably leave even the working out of broad principles to its infinite discretion.

Having thus dismissed the "occasion and the point of view," I arrive at this question of the broad principles. Luckily we are all agreed about them. There are only two :—

(*a*) The preservation of the health of the fit.

(*b*) The evacuation, care and early return to his place of the unfit, whether sick or wounded.

(*a*) The necessity of writing an essay for the enlightenment of the chief or his staff cannot, within my conception, arise. But both will want to know if any undue amount of sickness exists in the force, its cause and its remedy. Both will wish to be advised of measures *not* already in operation to prevent disease, as well as to be informed whether any, and if so what, diseases may be anticipated to be prevalent in the future, and whether the military situation, climate or any other factor, from A to Z, is in process of affecting, or may be expected to influence, their incidence.

These are absolute platitudes, but simply must be put in here, if my structure is going to stand up.

(*b*) The G.O.C. and staff will want to know :—

(i) The position at the moment as regards: (1) Number of sick in medical units; (2) number of wounded in medical units; (3) wastage, i.e., evacuations to overseas and to base; (4) number of vacant beds, and if margin is sufficient for any particular eventuality; (5) sick-rate in the force in any particular unit or area.

(ii) The situation as regards arrangements for evacuation; (1) by M.T.; (2) by train, etc.; (3) by ship, and what, if any, new arrangements are necessary,

(iii) Modifications, rearrangements which the military situation, as given by the staff, demands in regard to siting or resiting of medical

units requiring co-ordinated staff work, such as general hospitals, convalescent depots, C.C.S.'s, etc., or requirements in men or material.

No doubt there are very numerous omissions in this short draft, but I have already confessed myself an Amy-ite, and I note that his model appreciation covers less than four pages of typed foolscap. I should like mine to occupy not more than three pages, and if I could only get it down to two I should feel that I had established my point and sustained my argument.

It remains to apologize for the length of this dissertation, and finally to acknowledge the helpful criticism in the more constructive parts of this paper which I have had from Major-General R. S. Hannay, C.B., C.M.G., D.S.O., K.H.S.; Colonel Langford LLoyd, C.M.G., D.S.O.; and from Brevet Colonel J. Powell, D.S.O.

PRELIMINARY NOTE ON THE STERILIZATION OF BILHARZIA - INFECTED WATER.[1]

By Major H. S. BLACKMORE, O.B.E.
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A series of trials carried out with the apparatus devised by Major C. H. H. Harold, O.B.E., Royal Army Medical Corps, for the sterilization of drinking water by chloramine solution had proved so satisfactory that the question arose as to whether this method might prove effective in dealing with the very important problem of the purification of bilharzia-infected waters.

As the result of previous work, it has been generally accepted that the cercariæ remain alive for at least an hour in water containing from four to ten parts per million of available chlorine, and hence the use of chlorine for this purpose is unpractical under field service conditions. It might be used for fixed water-supply plants, where it could be combined with de-chlorination.

We were encouraged to try the effect of the chloramine solution because of its apparently much greater efficiency as a protoplasmic poison.

The standard strength of available chlorine in the chloramine procedure for the purification of water is one part per million. To enable us to reproduce this concentration in our small scale trial, the following calculations were made: To 104 gallons of water, 6 gallons of chloramine solution are added to produce 1 part per million of available chlorine. Therefore, if three cubic centimetres of chloramine solution are added to fifty-two cubic centimetres of water, a similar result will be attained.

An infected snail (*Planorbis boissyi*) was placed in a 100-cubic centimetre cylinder of tap-water until a sufficiently heavy contamination with cercariæ was obtained. To fifty-two cubic centimetres of this water three cubic centimetres of the chloramine solution, prepared according to the instructions for the mono-chloramine method, were added. The cercariæ were observed with the assistance of a hand lens. Immediately on the addition of the chloramine solution there was greatly increased activity. This was followed by complete cessation of movement after about five minutes. Following the cessation of movement, the cercariæ developed a "fluffy" appearance, in marked contrast to their previous sharp-cut outline. The typical "anchor-bar" shape normally presented when not in motion was lost, and they gave the impression of being upside down and of sinking gradually.

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[1] Received for publication on August 13, 1928.

Examination, at intervals, during the following twenty-four hours, yielded no sign of any return of mobility; the organisms gradually sank to the bottom and seemed almost to agglutinate.

Examination in hanging-drop preparation under a low power of the microscope showed them to be broken up, as it were, sometimes the bifid tail segment and sometimes the head and body segment being seen.

This experiment was repeated twice and the same results were obtained. These results were so different from what had been expected, that it was decided to change over to ordinary bleach solution, as controlled by the use of Horrocks' box.

Bleach of an available chlorine content of from twenty-two to twenty-five per cent was used, and a series of trials was carried out on similar lines to the foregoing.

Three different types of water were used: (i) Tap-water (as in the first series); (ii) unclarified water from the River Nile; (iii) water from the aquarium in which the snails were housed, and which closely resembled the water in any of the local irrigation channels, the natural habitat of the snails.

The usual "6-cup" test was carried out and the figure varied from 1 for the tap-water to 4 or 5 for the Nile and aquarium waters.

For the purpose of laboratory tests with small quantities of infected waters it was found convenient to use in each case 160 cubic centimetres, which was found to be the average amount contained in one white cup. This was chlorinated by the addition of the requisite number of drops from the Horrocks apparatus. Water so treated, if free from cercariæ, should show a trace of chlorine after half an hour's contact and would provide a bacteriologically safe water at that time.

The trials were carried out in graduated cylinders and with freshly secreted cercariæ, as before. The results were astounding. In all three types of water, on the addition of bleach, controlled as above to give the amount of chlorine necessary for destruction of pathogenic bacteria, the cercariæ became motionless in from five to fifteen minutes, and subsequently showed the same signs as had been observed in our previous experiments.

A possible objection seemed to exist in the smallness of our scale, that is to say, the distribution factor might come in. A drop of bleach solution in 160 cubic centimetres, well swilled round in a measuring cylinder, might conceivably expose the cercariæ to an individually bigger dose of chlorine than a scoopful in 110 gallons.

With this point in view, the cylinders were left for half an hour: the proper persistence of a trace of chlorine being demonstrated at the end of this period, and then the cercariæ were added. They all died within twenty minutes, loss of mobility being taken as evidence of death.

One further trial was carried out. A 110-gallon tank was set up on the bank of the River Nile and filled by means of a pump. The Horrocks test was carried out, and the four scoopfuls thus indicated were made into a

paste and added. After vigorous stirring for three minutes, some of the water which now gave evidence of much free chlorine, was added to an equal part of freshly infected tap-water. The cercariæ were dead in under five minutes, i.e., killed by less than the proportion of chlorine which would be employed for disinfection in the ordinary way.

Discussion.

The snails used were undoubtedly *Planorbis boissyi*.

The cercariæ obtained from these were bifid-tailed, closely resembling the picture of *Schistosoma* cercariæ, shown in fig. III, facing page 223 in "Memoranda on Medical Diseases in Tropical and Sub-tropical Areas" (fourth edition, 1924).

No animal inoculation tests have been carried out to prove their identity.

Conclusions.

Cercariæ obtained from snails of the species *P. boissyi* were rendered immobile, and in many cases showed evidence of disintegration, by approximately one part per million available chlorine, well within the thirty-minutes contact period ordinarily allowed for the sterilization of a drinking water.

These cercariæ showed close morphological resemblance to the pictured representation of *Schistosoma* cercariæ.

Without a greatly extended series of trials we are not prepared to draw any further, or more definite, conclusions.

The matter would seem worthy of further investigation, especially in view of the wide interests at stake.

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NOTES ON THE HISTORY OF THE MEDICAL STAFF CORPS AND ARMY HOSPITAL CORPS, 1854-1898.

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps.

The Medical Staff Corps was first constituted during the Crimean War in succession to the short-lived Army Conveyance Corps dispatched to Turkey at the commencement of the campaign to carry the wounded off the field and provide attendants for the general hospitals. The Director-General had urged the necessity of enlisting able-bodied men for the duty, but his advice was disregarded, the Corps consisting of pensioners and other ineffectives. Few, if any of them, reached the fighting zone, and neither they nor their ambulances were present at the battle of the Alma, fought a few days after landing in the Crimea. The wounded on this occasion were cleared to the ships by parties of bluejackets. In the subsequent march inland, numbers of those who fell out, some of them stricken with cholera, were never heard of again. The pensioners proved too feeble or too alcoholic for their duties and quickly disappeared. The nursing duties in the staff hospitals were then performed largely by details from the combatant ranks, or convalescents retained in hospital who should have been back with their units, The regimental bandsmen were used as stretcher bearers in the field, and the evacuation of the sick and wounded behind the regimental hospitals became the responsibility of the Land Transport Corps. The regimental hospitals had, of course, their own surgeons and orderlies as in peace time.

In June, 1855, a Medical Staff Corps of nine companies, each of seventy-eight men, was formed. Each company was calculated to supply the staff for a general hospital of 500 beds. It had no military organization, and after three months was reorganized with the addition of an extra company, receiving, according to Gore,[1] a grey uniform with scarlet facings. The Corps was given a quasi-military character in that the warrant ruled that every man enlisted "should be liable to be sentenced for misconduct by court martial to be reduced to the ranks of the Army and to be sent to any regiment of the line to serve therein with the rank and pay of a private sentinel." In practice, this punishment did not work, as the men were civilians, and one may well believe that commanding officers could make considerable difficulties about accepting men under these conditions. In any case the question of the preservation of discipline in the hospitals must have been a difficult one, for the staff surgeons, like their brother officers

[1] Surgeon Major A. Gore, "Our Services under the Crown."

with regimental commissions, had no powers of command, and the same applied to the subordinates who supplied the place of N.C.O.'s.

In June, 1856, this Corps was 1,188 strong. The grades were steward, wardmaster, assistant steward, assistant wardmaster, and 1st and 2nd class orderly, with relative ranks of serjeant-major, colour-serjeant, serjeant, corporal and private. The uniform was blue with scarlet facings. The undress consisted of a blue frock, like a butcher's, designed by Captain Stonehouse George Bunbury, who had been staff captain in charge of the depot since June 22, 1855. He was very pleased with it, but it was not appreciated by those who had to wear it. The command of the Corps was vested in Captain Bunbury who had served previously in the 60th and 67th Regiments. He had as his assistant Captain Richard Sweet Cole, late 91st and 12th Foot.

In 1857 a detachment of the Medical Staff Corps embarked for the second China war under Deputy Inspector-General Dane, the rest of the party comprising 3 first class and 8 second class staff-surgeons, 16 assistant staff-surgeons, an apothecary, 3 dispensers, 3 medical clerks and 8 purveyors' clerks.

As a result of the report of a Parliamentary commission, the Corps was completely reorganized in the course of the next three years. The Royal Warrants under which it was carried out were dated August 1, 1857, and September 27, 1861. In the Army List of 1860 the name is changed to "Army Hospital Corps," to which Captains Bunbury and Cole were commissioned on August 1. This is the same Corps, which under the revived title of Medical Staff Corps, was amalgamated with the Army Medical Staff to form the Royal Army Medical Corps in 1898. By the terms of the warrant the ranks were now to be normally filled by volunteers from the line, who were to be of good character, of over two years' service, and be able to read and write. They were not to be finally accepted until they had undergone three months' probation, and at any period of their service might be reverted for misconduct. In place of the old grades ordinary military rank was conferred on the non-commissioned officers. The terms under which volunteers were accepted expressly laid down that in time of war the members of the Corps would be liable for employment with ambulances and to remove wounded from the field.

Up to 1863 the headquarters of the Army Hospital Corps were at Fort Pitt, Chatham. When the medical school was removed to Netley in the spring of that year, the depot went with it. Henry Savile became Adjutant and Quartermaster. Bunbury, now a Major, retired as Lieutenant-Colonel on full pay (July 1) and Cole on half-pay as Major. The general hospital at Netley had a combatant officer as Governor, with a staff consisting of an infantry captain, a paymaster and a captain of orderlies. The soldier represented in drawings of this period had whiskers and a moustache. In full dress he wore a shako of which a new and improved pattern had been issued in 1862. The Pimlico records indicate that the

Army Hospital Corps had a blue tunic with scarlet facings and blue trousers with a scarlet welt. The undress cap was a round forage cap with the A.H.C. monogram. The Army List gives the uniform as blue with blue facings, which presumably was that worn by the officers. The medical officers, other than the regimental ones, had a plain scarlet tunic. It was at first contemplated that the Hospital Corps should supply attendants for the regimental as well as the general hospitals in Great Britain and the Colonies. Their numbers were, however, insufficient for this purpose, and a combined system of corps and regimental orderlies proved unsatisfactory. It was accordingly laid down by Royal Warrant of September 27, 1861, that their duties should be confined to general, depot and field hospitals. Half were to be employed on medical duties and the other half as purveyors' orderlies. Both these branches were represented on the staff of a hospital, of which the hospital storekeeper in the Indian establishment seems to be a relic. The purveyors branch of the A.H.C. was not transferred to the Corps responsible for the general service of Army supplies till October, 1868.[1]

Another provision of this warrant authorized the appointment of serjeants as *compounders* after examination, and a grant of extra pay.

Meanwhile the old regimental orderlies were retained in their hospitals, but it was laid down that they should be regarded as supernumerary to the establishment of combatants, should be unarmed except for a sword designed for self defence, and while continuing to wear the regimental uniform, should be provided with distinctive badges. Both they and the men of the A.H.C. were to undergo instruction in a general hospital. The medical officers were still without power of command over the men who worked under them. In 1867 the strength of the Corps in the medical section was 454. Of this number 109 were in the Colonies or on service, and 345 distributed among forty-three stations in the United Kingdom.

In the reorganization of the administrative services which followed the Crimean War, the influence of Miss Nightingale was a dominant factor. In the medical branch, besides the institution of Army Nurses, the foundation of Netley and the Royal Herbert hospitals, the Army Medical School, and the organization of the Army Hospital Corps have been claimed as her work. It is certain that she used her unique position to press these matters on the Government, and that she was consulted on every point. She nominated the professors at the school, and, on Sir Andrew Smith's retirement, she secured Alexander's appointment as Director-General in

[1] Towards the end of the eighteenth century the *purveyors*, who were storekeepers and accountants, and responsible for the domestic economy of the hospitals, were appointed from the senior staff and regimental officers whose pay did not exceed 10s. a day. After 1805 the appointments were given to non-medical men. The *purveyors* were at that time eligible for charge of hospitals. For example, in 1806, the P.M.O. at Plymouth general hospital was a *purveyor*, having a physician and a staff-surgeon serving under him. Abolished in 1830, *purveyors* were reappointed for the Crimean campaign.

supersession of Sir John Hall, the I.G.H. during the war. She was consulted confidentially on the claims of senior officers to preferment. Beneficial as her activities were, many of the senior officers, including the Director-General, may be excused if they breathed a sigh of relief when she passed on to reform someone else's department.

Though the new Corps might afford a partial solution of the problem of staffing our hospitals in war, the question of the removal of the wounded from the field remained unsettled. This was discussed in Sir Thomas Longmore's "Treatise on the Transport of Sick and Wounded Troops," published in 1869. He argued that the Army Hospital Corps, composed as it was largely of ex-soldiers, could not readily be expanded at a time when the material from which it was drawn would be urgently wanted for the combatant ranks, but, if it was to carry out the duties for which it was intended, its numbers must clearly be largely increased. The matter took many years to settle, and the intention to relieve the fighting troops entirely from the business of carrying wounded to the rear has never been fulfilled. The Act of 1870 prescribed a reserve for the A.H.C. which to a certain extent, provided the necessary increase when the reserve was called up.

The condition of the staff and regimental officers at this period must now be referred to. Lord Herbert's commission of 1857 had secured for them an improved status, better pay, and better prospects. They were promised the same share of honours and rewards as the combatants, and honorary physicians and surgeons to the King were appointed from among their number. First and second class Staff Surgeons became Surgeon Majors and Surgeons, ranking as Lieutenant-Colonels and Majors, and the relative rank conceded to them was defined as carrying with it all precedents and advantages except the presidency of courts martial. In 1857, open competitive examination replaced nomination as a mode of entry, and accepted candidates went to the military hospital at Fort Pitt for a probationary period in the wards. Apart from this, however, the majority still spent their service within the narrow sphere of a regimental hospital, and with no opportunity or inducement to study in peace the problems of medical administration in war, or to acquire the habit of command.[1] The establishment of the Army Medical School at Fort Pitt in 1860, and the work done by its successors have conferred immense benefit on the service and on the Army generally, but it was designed for the improvement of scientific knowledge and not as a school of medical administration in war.

The modern conceptions of the duties of the military medical service had their beginnings in the year 1873, when the regimental hospital

[1] Sir James Brown Gibson, the D.G., seems to have recognized the value of war training for the medical officers in time of peace. When I.G. Hospitals at Aldershot, in 1857, he set up a marquee outside the hospital huts to represent a field hospital for instructional purposes. The accounting branch was much shocked at this re-appropriation of war material, and he was compelled to justify his proceedings before higher authority.

system, except in the Guards, was abolished, and all medical officers were placed in one department. Military hospitals were ordered to be administered as general, station or field hospitals, and steps were taken in the same year to develop the Army Hospital Corps from its scattered condition into a strong Corps doing all hospital duties. Twenty-one "captains and lieutenants of orderlies" were appointed, who were maintained by the promotion of N.C.O.'s from the ranks of the Corps; apothecaries ceased to be appointed from this date.[1] A staff officer, quartermaster, and paymaster dealt with the administrative duties, the staff officer appointed this year being Ensign and Captain of Orderlies David Pringle, who still had the post in 1881. The P.M.O. was given control of the personnel serving in his station subject to the control of the local military authority.

Four years later (1877) the important step was taken of granting to the A.M.D. officers power of command over the A.H.C. patients in hospital, and men of other corps attached for duty. The new system was somewhat gradually developed. There was considerable obstruction in high places, successfully overcome by the tact and firmness of Sir William Muir, the D.G. Many medical officers, though now designated A.M.D., remained attached to their regiments. As a general hospital, the Royal Victoria Hospital at Netley was flourishing. The Royal Herbert Hospital at Woolwich is described by Surgeon-General Evatt as a series of regimental hospitals thrown confusedly together. In 1875 there were station hospitals at all large military centres. All medical officers in the station were available for such duties as the P.M.O. might direct, but separate wards in the hospital were allotted to the different corps, and their sick were kept as far as possible distinct and under the immediate care of their own M.O. and orderlies. The hospital staff consisted of all the M.O.'s attached to regiments, a certain number of officers specially detailed, men of the A.H.C and the surviving hospital serjeants and orderlies of the regiments. The strength of the Corps at this date was 21 officers, 264 warrant officers and serjeants, and 1,060 rank and file. Of the A.M.D. officers, 476 were at home, 130 in the Colonies, and 501 in India.

During the years succeeding the reorganization of the services, schemes for war were worked out. One medical officer was to be attached to each battalion or equivalent unit, and sixteen stretcher bearers, who had received some preliminary training, were to be found regimentally. An army corps of three divisions was to have 4 bearer companies, each composed of 8 officers and 200 other ranks A.H.C. and drivers. There were twenty-five field hospitals, each providing for 200 patients, and staffed by 7 medical officers, an officer of orderlies as quartermaster, and 37 A.H.C. These were to be *movable* or *stationary* as required. The arrangement anticipated seems to have been that there should be two to a division, six in reserve

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[1] The rank af apothecary was abolished in 1830, but revived in 1854. On the reorganization of the A.H.C., in 1873, several of the apothecaries became officers of orderlies.

behind the front line, and the remainder on lines of communication or at the base. The general base hospital as we know it to-day was not provided for in establishments. If required, it had to be specially made up to suit the need of the moment. Ships were much favoured for the purpose. A scale of transport for field units was compiled, but history shows that when it came to the point, most of it was wanted for something else. Field hospitals took part in the autumn manœuvres of 1872.

The A.H.C. depot and training school at Aldershot appear in the 1880 Army List with Surgeon Major Sandford Moore as Commandant. This officer was the author of a "Manual for Stretcher-bearers and Bearer-companies," which was published by authority. The first Corps manual appears to have been written in 1870 by Surgeon Andrew Moffit, who for long superintended the instruction of the men at Netley. The Aldershot depot staff included, besides the commandant, an instructor, assistant instructor, and adjutant, the last a captain of orderlies. In 1882 a medical officer, Surgeon-Major William Johnston, became staff officer. To him we owe the invaluable "Rolls of Commissioned Officers," edited by Lieutenant-Colonel Howell in 1917. In 1883 Surgeon Major-Gasteen was Commandant. Surgeon-Major S. K. Ray succeeded him in 1885, and in 1888 was succeeded by Surgeon-Major Johnston above mentioned.

During the years following the Crimean war the regimental surgeons served with their units in the Indian Mutiny (1857-8), the China war (1860)[1] the Maori war (1863-4)[2] and in Sir Robert Napier's expedition (1867).[3]

Their services were recognized by the grant of seven Victoria Crosses, two of which were earned in New Zealand, three in India, and one in the Andaman Islands. In the Munity the A.H.C. can scarcely have been represented, unless among drafts diverted at the Cape when *en route* to China. The Corps supplied detachments for the staff hospitals in China and New Zealand. The Magdala expedition was organized in India, but some of the men undoubtedly served during this campaign, having come out, no doubt, in the hospital ships sent from England for service at the base. In all the above-mentioned wars the regimental hospitals were employed besides the general hospitals. In Sir Garnet Wolseley's advance on Kumasi (1874) 73 medical officers participated, and 3 officers and 261 other ranks of the A.H.C. were employed in the two mobile field hospitals, the stationary field hospitals, and the hospital ships. The latter were, as in other similar campaigns of this era, regarded, not only as carriers, but as base hospitals. The sick-rate was very high. Sir A. D. Home, V.C., the first P.M.O., was invalided, being succeeded by Surgeon-Major W. A. Mackinnon, an officer who had distinguished himself in the Maori war by leading a successful assault on a fortified position when the regimental

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[1] A.M.D. Reports, 1860, Dep. Surg.-Gen. Muir, P.M.O.

[2] A.M.D. Reports, 1865 and 1866.

[3] Report by Dr. Currie, P.M.O., A.M.D. Report, 1867.

officers had become casualties. He subsequently became Director-General.

In 1868 a set of regulations was drawn up for the female nursing staff of Netley Hospital. Shortly afterwards nurses are found at the Royal Herbert Hospital at Woolwich. It is not always realized that the Army nurse dates from a much earlier period than that of Miss Nightingale's activities. The reorganization of the medical service of the Army in Ireland during the reign of William III included the provision of forty nurses in the hospitals. During the Napoleonic Wars nurses were employed in the general hospitals at home. That at Gosport, in 1806, had a head nurse, two nurses and a sempstress, paid at the rate of 1s. a day, with rations, and a matron at 2s. 6d. The organization of Queen Alexandra's Imperial Military Nursing Service for extended duties in all large military hospitals took place in 1902.

THE GALAEKA-GAIKA WAR OF 1877.

In the autumn of 1877 the Imperial Government dispatched troops to South Africa to aid the colonists, who had become involved in operations against the Galaekas and the Gaikas, two of the great Kafir tribes. Four infantry regiments with artillery were engaged, and a constantly varying number of colonial volunteers, police, and native levies. We seem to have drifted into the war, and little or no administrative preparations were made beforehand. Surgeon-General J. A. Woolfryes, C.B., the P.M.O. at the Cape, was responsible for the medical arrangements. At the commencement, only two regular medical officers and three colonial surgeons were at his disposal; a few civil surgeons were, however, procured locally. "They were untrained, of course, in the common routine of a military hospital, and could not, or would not furnish the necessary returns, and some of them were not amenable to discipline." The Surgeon-General, to whom the campaign must have been something of a nightmare, had even greater difficulty with the subordinate personnel. The hospitals went into the field without a single man of the A.H.C. attached to them, the staff being formed of orderlies grudgingly detailed by column commanders at the last moment. The commissariat department had to be provided for in the same way. No men could be spared for regimental stretcher bearers, and the Kafirs enlisted for the purpose all deserted. The ambulance wagons were the cumbrous wagons of the country, drawn by sixteen to eighteen oxen and with a speed of a little under a mile an hour. As no escorts could be provided for movable field hospitals on the march, it was decided to immobilize them, and what are described as flying hospitals only went with the columns. On June 24, four days after the termination of hostilities, seven civil surgeons arrived from England.

This campaign is mentioned, as it gives some indication of the

difficulties with which a P.M.O. had to contend during the period following the abolition of regimental hospitals, and before things settled down.

This year the shako was discarded as a head-dress, and the helmet was issued. The following year the forage cap was superseded by the glengarry. It was reintroduced in 1891.

The Zulu War of 1879.

Surgeon-General Woolfryes was still P.M.O. at the Cape when the invasion of Zululand took place. He then had under his command an average strength of sixty-nine officers of the A.M.D and eight officers of orderlies. A number of civil surgeons were also employed. At the commencement of the war the strength of the A.H.C. was 124. These were supplemented by drafts amounting to 310 during the campaign. The regulation field hospital of 200 beds was divided into eight separate units for convenience in dealing with small bodies of troops. Each of these units was allotted two M.O.'s. two A.H.C., a cook and a wagon orderly. The transport consisted of an ambulance wagon, a store wagon, a water cart and two pack horses. The authorized transport personnel was never supplied, and the service suffered from having civilian or native drivers. The most advanced field hospital was usually made up of two of these units, but the medical officers were not increased. For every batch of ten patients after the first, a regimental orderly had to be demanded. The ambulance wagons were either the unwieldy country wagons used in the late campaign fitted with a spring floor, or converted store wagons. Later on, thirty regulation ambulances were sent from home. Regimental units had a M.O. attached, and two stretcher-bearers per company. Each soldier was supposed to carry a piece of lint and a bandage in his left hand trousers pocket as a first field dressing. Base hospitals were formed at Durban, Pietermaritzburg, Ladysmith, Newcastle and Utrecht, and auxiliary hospitals and convalescent depots were subsequently added. Except where station hospitals already existed, these base hospitals seem usually to have been stationary field hespitals. The equipment of a stationary and a movable field hospital only differed in the fact that the former had twice as much clothing.

Towards the end of the war, a party of Netley nurses under Mrs. Deeble was sent out, "whose example of devotion to duty had a most beneficial effect on the men of the A.H.C." Lord Chelmsford's force crossed into Zululand about January 6, 1879, in four columns, and at four different points, being formed of two infantry battalions, or the equivalent, a detachment of mounted troops (mostly volunteers or irregulars), three or four guns and a native contingent. To each was attached a bearer party of 8 A.H.C., and 40 native carriers with 8 Ashanti cots, additional to its field hospital establishment.

The first news of the fighting to reach England was that of a serious

disaster to No. 3 column under Colonel Glynn, which, advancing from Helpmaakar had crossed the Buffalo river at Rorke's Drift. At the latter a store depot was established, and a hospital of forty beds, in charge of Surgeon James Henry Reynolds, the garrison being formed by a company of the 2/24th Regiment. The remainder of the force proceeded to camp some twelve miles further east at the foot of Isandhlwana mountain. From here on January 22, accompanied by the Commander-in-Chief, Colonel Glynn led out part of the troops on a reconnaissance, leaving the 1/24th, a company of the 2/24th, a section of a battery, and some volunteers and native auxiliaries in the unfortified camp. During the absence of the main body the Zulus appeared in great force, attacked the camp, and the defenders after a gallant resistance were killed almost to a man. Among the dead were Surgeon-Major P. Shepherd, Lieutenant and Acting-Surgeon Boué of the native contingent, Lieutenant of Orderlies A. Hall and eight men A.H.C. Six ambulance wagons and all the medical equipment were lost.

The Commander-in-Chief's party, on their return in the evening, bivouacked amid the wreck of the camp and the mutilated corpses of their comrades, without food, and almost without ammunition, expecting an attack at any moment. At 4 a.m. a start was made for the post at Rorke's Drift, about the fate of which there was the utmost anxiety. On approaching the spot, smoke was seen to be rising, but shortly, to everyone's relief, British cheers were heard.

De Neuville's picture of the defence of Rorke's Drift hangs in the corridors of many of our military hospitals, and the story is familiar to most of us. It is unlikely, however, that many of the present generation have had an opportunity of reading Surgeon-Major Reynolds' own account of the fight, which is to be found in the A.M.D. Reports, 1878.

"At 1.30 a large body of natives marched over the slope of Isandlana in our direction, their purpose evidently being to examine ravines and ruined kraals for hiding fugitives. These men we took to be our native contingent. Soon afterwards appeared four horsemen on the Natal side of the river galloping in the direction of our post, one of them was a regular soldier, and feeling they might possibly be messengers for additional medical assistance, I hurried down to the hospital as they rode up. They looked awfully scared, and I was at once startled to find one of them was riding Surgeon-Major Shepherd's pony. They shouted frantically, 'The camp at Isandlana has been taken by the enemy and all our men in it massacred, that no power could stand against the enormous number of the Zulus, and the only chance for us all was by immediate flight.' Lieutenant Bromhead, Acting-Commissary Dalton, and myself, forthwith consulted together, Lieutenant Chard not having as yet joined us from the pontoon, and we quickly decided that with barricades well placed around our present position a stand could best be made where we were. Just at this period Mr. Dalton's energies were invaluable. Without the smallest delay, he

called upon his men to carry the mealie sacks here and there for defences. Lieutenant Chard [R.E.] arrived as this work was in progress, and gave many useful orders as regards the lines of defence. He approved also of the hospital being taken in, and between the hospital orderlies, convalescent patients (eight or ten) and myself, we loop-holed the building and made a continuation of the commissariat defences round it. The hospital, however, occupied a wretched position, having a garden and shrubbery close by, which afterwards proved so favourable to the enemy; but, comparing our prospects with that of the Isandlana affair, we felt that the mealie barriers might afford us a moderately fair chance.

"At about 3.30 the enemy made their first appearance in a large crowd on the hospital side of our post, coming on in skirmishing order at a slow slinging run. We opened fire on them from the hospital at 600 yards, and although the bullets ploughed through their midst and knocked over many, there was no check or alteration made in their approach. As they got nearer they became more scattered, but the bulk of them rushed for the hospital and the garden in front of it.

"We found ourselves quickly surrounded by the enemy with their strong force holding the garden and shrubbery. From all sides, but especially the latter places, they poured on us a continuous fire, to which our men replied as quickly as they could reload their rifles. Again and again the Zulus pressed forward and retreated, until at last they forced themselves so daringly, and in such numbers, as to climb over the mealie sacks in front of the hospital, and drove the defenders from there behind an entrenchment of biscuit boxes, hastily formed with much judgment and forethought by Lieutenant Chard. A heavy fire from behind it was resumed with renewed confidence, and with little confusion or delay, checking successfully the natives, and permitting a semi-flank fire from another part of the laagar to play on them destructively. At this time, too, the loopholes in the hospital were made great use of. It was, however, only temporary, as, after a short respite, they came on again with renewed vigour. Some of them gained the hospital verandah, and there got hand to hand with our men defending the doors. Once they were driven back from here, but others soon pressed forward in their stead, and, having occupied the verandah in larger numbers than before, pushed their way right into the hospital, where confusion on our side naturally followed. Everyone tried to escape as best they could, and, owing to the rooms not communicating with one another, the difficulties were insurmountable. Private Hook, 2/24th Regiment, who was acting as hospital cook, and Private Conolly, 2/24th Regiment, a patient in hospital, made their way into the open at the back of the hospital by breaking a hole in the wall. Most of the patients escaped through a small window looking into what may be styled the neutral ground. Those who madly tried to get off by leaving the front of the hospital were all killed with the exception of Gunner Howard.

"The only men actually killed in the hospital were three, excluding a

Kafir under treatment for compound fracture of femur. Their names were Serjeant Maxfield, Private Jenkins, both unable to assist in their escape, being debilitated by fever, and Private Adams, who was well able to move about, but could not be persuaded to leave his temporary refuge in a small room. The engagement continued more or less until about 7 o'clock p.m., and then, when we were beginning to consider our situation rather hopeless, the fire from our opponents appreciably slackened, giving us some time for reflection. Lieutenant Chard here, again, shined in resource. Anticipating the Zulus making one more united dash for the fort, and possibly gaining entrance, he converted an immense stack of mealies standing in the middle of our enclosure, and originally cone fashioned, into a comparatively safe place for a last retreat. Just as it was completed, smoke from the hospital appeared and shortly burst into flames. During the whole night following, desultory firing was carried on by the enemy, and several feigned attacks were made, but nothing of a continued or determined effort was again attempted by them. About 6 o'clock a.m., we found, after careful reconnoitering, that all the Zulus with the exception of a couple of stragglers had left our immediate vicinity, and soon afterwards a large body of men were seen at a distance marching towards us.

"I do not think it possible that men could have behaved better than did the 2/24th and the Army Hospital Corps (three), who were particularly forward during the whole attack."

Besides Lieutenants Chard and Bromhead, Surgeon J. H. Reynolds and five of the 24th received the Victoria Cross for their gallant defence of the hospital. Reynolds omits in his narrative the fact that during the most critical part of the struggle round the hospital, he crossed and recrossed the space between the building and the store to bring a fresh supply of ammunition under heavy fire.

The news of the disaster at Isandhlwana produced such consternation in England as it is at this date difficult to realize. It is not too much to say that the possibility of British troops being out-generalled and out-fought by half-naked savages, had never occurred to the public at that time. Reinforcements, which included, of course, medical personnel, were hurriedly got ready. Meanwhile, Natal was put in a state of defence, and all the columns, except Colonel Pearson's, which entrenched itself at Ekowe, withdrew towards their bases. The remnants of No. 3 fell back on Helpmakaar, and Colonel Evelyn Wood, who was the mainstay of our considerably disheartened troops, established a fortified camp at Kambula, covering Utrecht in the Transvaal. Ekowe was relieved by Lord Chelmsford, early in April. In March, Wood's column did some hard fighting. His medical staff consisted of the usual field hospital detachments, with Surgeon-Major O'Reilly as S.M.O., and a party of native bearers. On March 28, a force of mounted troops and irregulars, part under command of Lieutenant-Colonel Redvers Buller, were surrounded, and nearly cut off on the Zlobane mountain. During the stampede back to camp, in which Buller earned his

V.C., and during which many casualties occurred, Civil Surgeons Jolly and Conolly were the last in the retirement, pursued by several thousand Zulus, and frequently dismounting to assist wounded. In the attack on the camp next day, the whole medical staff and their orderlies won the approbation of the column commander. During the hottest part of the fight, and in a very exposed part of the camp, Brown and Thornton, two regular surgeons, successfully amputated an arm. The enemy were utterly routed in the end, and pursued by the mounted troops. During May, the troops were concentrated in two very weak divisions, under Generals Crealock and Newdigate, and a flying column under Brigadier-General Evelyn Wood. The first division troops, of which Surgeon-Major Tarrant was S.M.O., were concentrated round Ginginlovo, and remained stationary in the unhealthy, low-lying country near the coast till late in June. The situation was aggravated by the absence of any sanitary efforts on the part of the troops in the camps of the colonial irregulars, and of the friendly Zulus. Malaria, dysentery, and enteric were prevalent, and the medical staff and A.H.C. had a hard time. The hospitals at Fort Chelmsford and Fort Pearson were evacuated by road to Durban, except for the last fifteen miles, which was done by train. For this purpose, ten English ambulance wagons were employed, and rest stations in charge of A.H.C. non-commissioned officers were established on the road. From Fort Pearson to Durban is seventy miles. After the advance, the sea route from Port Durnford was available.

The second division, which, with the flying column, did most of the fighting during the second phase of the war, were more fortunate, as they were operating in the healthy upland country of central Zululand. Surgeon-Major Giraud was the S.M.O. On May 20 a junction was effected with Wood's flying column at Inceni mountain, and the combined force of 4,062 Europeans and something over 1,000 natives advanced eastward. The Commander-in-Chief, on whose staff was the Prince Imperial, accompanied them. After the tragic death of the latter, his body had to be embalmed on the spot, and dispatched to the base in an ambulance. On July 4, Lord Chelmsford met the enemy at Ulundi. Taught by bitter experience, no mistakes were made this time. The force drew out in a square, against which the Zulu attacks were vainly expended, and a charge delivered by the 17th Lancers completed the victory. Our losses amounted to no more than nineteen killed and eighty-nine wounded. During the action, casualties were attended to at the field hospital, in the left rear of the square.

The evacuation of wounded and sick from the force, during its advance, was to Koppie Allein by sick convoy, whence the more serious cases proceeded to Ladysmith via Dundee, and the remainder to Utrecht.

The first division advanced no further than Port Durnford. The war ended with the capture of King Cetewayo, by the mounted troops, early in September.

The Zulu war having been brought to an end, an expedition was undertaken against a chief named Sekukuni, who had given constant trouble to

the Transvaal Government. From our point of view it is mainly of interest for the employment of what has been described as the first bearer company. This company was trained in South Africa, by Surgeon-Major James Hector, the personnel consisting of 2 N.C.O.'s and 24 men of the 21st Regiment, the same number from the 94th, a serjeant and 17 men A.H.C. to perform the duties of No. 4 bearers, and 65 Kafirs. Surgeon-Major Hector commanded, and Surgeon Lloyd was the other officer.[1]

The two battalions from which the bearers were taken represented the regular infantry at the assault on Sekukuni's town on November 28, 1879, and the fourteen stretcher squads, manned by Europeans, followed them up closely. The Kafirs, with their stretchers, formed a relay 150 yards in rear, and carried back the wounded to a dressing station supplemented by officers and personnel from the field hospital. Ambulance wagons then took the patients to the main dressing station. It will be observed that the bearer company on this occasion combined the duties of regimental stretcher bearers with their normal function.

(*To be continued.*)

[1] "The First Bearer Company," *Journal of the Royal Army Medical Corps*, Vol. xvi.

Editorial.

BACTERIOLOGICAL EXAMINATION OF WATER.

For many years bacteriologists have endeavoured to find tests which would indicate contamination of a water supply with human excretal matter. Following on the discovery of the *B. coli*, great attention was given to this microbe, but later it fell into discredit. Investigations soon showed that the *B. coli* was not confined to the human intestine, and numerous observers reported its presence in the excreta of animals. Many eminent bacteriologists declared that it had no significance as an indicator of contamination of a water supply. In 1894, Kruse stated that "the *Bacterium coli* is in no way characteristic of the fæces of men and animals. Such bacteria are found everywhere—in the air, in the earth, and in water from most varied sources." Weissenfeld declared that "the so-called *B. coli* may be found in waters from any source, good or bad, if only a sufficient quantity be taken for analysis." Levy and Bruns claimed that the existence of colon-like organisms in air, dust, and in unpolluted water, made it impossible to decide whether true colon bacilli were present in water or not. They considered that pathogenicity for guinea-pigs was the characteristic of true *B. coli* from the human intestine. This was disproved by Savage and other workers. Jordan stated that in spring water which was beyond any suspicion of contamination there could be found bacilli which in form, size, growth on potato, etc., were indistinguishable from *B. coli commune*."

The description of the characters of the *B. coli* given by many of these bacteriologists was quite inadequate, and, some twenty-seven years ago, in an "Introduction to the Bacteriological Examination of Water," written for the instruction of surgeons-on-probation at Netley, an endeavour was made to give standard reactions for the *B. coli*. These were stated to be: a Gram-negative bacillus, varying in motility, which does not form spores, does not liquefy gelatine, produces acid and gas in glucose and lactose, reduces nitrates to nitrites, produces indol in peptone water, changes neutral red from red to yellow, coagulates milk in twenty-four hours, gives a yellowish-brown growth on potato, produces acid in Proskauer and Capaldi's medium No. I, and no change, or a slightly alkaline reaction, in No. II.

When examinations were made of the excreta from man and animals, other types were found which varied from the standard by failing to produce gas in some of the sugar media, indol in peptone water, and changes in neutral red. Many of the variants were found to be practically identical with bacilli found in apparently virgin soils and on certain plants. Out of 150 cultures from normal and typhoid stools studied at Netley, some sixty per cent were typical; the remainder failed in one or more of the standard

tests. Houston obtained very similar results. Obviously the presence of these atypical bacteria alone could not be regarded as indicating fæcal contamination of a water supply. In our experience at Netley, when true fæcal contamination of recent date occurred, the typical *B. coli*, giving the standard reactions, could always be found, as well as the atypical varieties. If the contamination were not repeated our experiments showed that the *B. coli* gradually died out, and some of the standard reactions, especially the formation of indol, were lost by bacilli which had been typical in every way before immersion in sewage and water.

If we accept the standard reactions suggested for the *B. coli*, we are still faced with the difficulty that its presence does not necessarily indicate human contamination. Much work has been expended in the endeavour to find tests which would distinguish between the *B. coli* of human and that of animal origin, but up to the present with little success.

With the object of distinguishing bacteria of a fæcal origin from those of a non-fæcal origin, organic acids and their salts have been suggested as a source of carbon necessary for growth. In 1892, Van Ermengen and Van Laer reported that the *B. coli* could break down formic acid, citric acid, and tartaric acid with the formation of hydrogen, carbon dioxide, and methane. In 1896, Proskauer and Capaldi employed ammonium salts of organic acids in the study of *B. coli*. In 1921, Brown showed that *B. lactis aerogenes* and *B. cloacæ* grew in citrate media, but the growth of *B. coli* was inhibited. In the same year, Pesch found *B. paratyphosus* B would grow in citrate media, but twenty strains of *B. coli*, *B. typhosus* and *B. paratyphosus* A failed to develop. In 1923-4, Koser published the results of his investigations on the utilization of salts of organic acids by typical *B. coli*, *B. lactis aerogenes*, and atypical strains of the coli groups. He employed a medium containing $NaCl$, $MgSO_4$, $(NH_4)H_2PO_4$, K_2HPO_4, and to this the various acids were added and the reaction was then adjusted to pH 6·5 by the addition of NaHO, the concentration of the sodium salts being approximately 0·2 per cent. A solution containing 0·2 per cent sodium citrate was found most useful; in this typical *B. coli* refused to grow, but *B. aerogenes* and the atypical strains grew abundantly, the pH reaction being changed from 6·7 to 8·8. About 118 strains from men and animals and 72 strains from soils were tested. The *B. coli* from fæces could not utilize the citrate, but the *aerogenes-cloacæ* type from soils did. Repeated cultivation in citrate did not appear to affect the *B. aerogenes*, as after fifty passages it was still able to make use of the citrate to obtain the carbon necessary for growth. Continuous cultivation of *B. coli* did not enable the bacillus to utilize citrate, and after being added to soils and to water when again isolated it was still unable to grow in citrate. According to Koser, the citrate test gave results correlating with the sanitary survey of the water supply more closely than did any of the other tests.

The Voges-Proskauer test, that it is to say the production of an eosin-like colour on the addition of KHO to the growth in glucose peptone

water, has been suggested as a useful aid in diagnosis of fæcal from non-fæcal bacteria, especially when taken in conjunction with the changes in methyl-red and the production of indol. A microbe which will not grow in citrate, produces indol, changes methyl-red to yellow and gives no Voges-Proskauer reaction has been considered to be of fæcal origin, while one which is methyl-red negative and Voges-Proskauer positive is thought to be almost certainly derived from soil.

Koser also used a synthetic uric acid medium and submitted to these four tests 107 bacilli of the colon group, obtained from polluted waters, and 90 from water of high sanitary quality from springs and brooks. The proportion of methyl-red positive cultures was found to be almost the same in each class of water. These organisms constituted 80·4 per cent of the colon group of cultures obtained from polluted water and 73·3 per cent of those from unpolluted water. In a similar manner the results of the Voges-Proskauer reaction, and of the uric acid test, failed to correlate with the sanitary survey of the water supplies. The test of citrate utilization on the other hand showed some degree of correlation with the sanitary survey. Citrate-negative cultures (similar to fæcal *B. coli*) constituted 64·5 per cent of the colon group of organisms from polluted water and 16·7 per cent of those from waters of high sanitary quality.

Houston concludes from the work carried on in his laboratory that the citrate test would not be of much value in connexion with the examination of London water supplies. With lactose + indol + microbes the citrate test, it is true, yielded negative results, but some non-typical coli-form organisms likewise gave a negative result. In general the citrate test confirmed the significance of the lactose + indol + microbes, but sometimes failed to rule out of count the non-typical coli-form bacteria. He thinks, however, that Koser's own work is in favour of the citrate test being of considerable value in judging new and doubtful sources of supply. He points out that bacteriologists are too eager to deny recognition to the *aerogenes* group of organisms, because they are apt to be associated with washings from soils. Yet it is in times of flood when "unchartable" pollutions are swept into water courses that these organisms are particularly noticeable and few will deny that floods are not periods of epidemiological danger.

Last year Hicks studied the methods for the differentiation of the *coli-aerogenes* group when applied at Shanghai. He examined 200 organisms of the *coli-aerogenes* group of which 100 were human, 50 animal and 50 from soil. He found 76 per cent of the soil organisms were MR + and VP −, 20 per cent were MR − VP +, and 4 per cent MR − and VP −, while 66 per cent were citrate + and indol −.

Of the fæcal strains, human and animal, 92·7 per cent were citrate −, 91·3 per cent indol +, 95·3 per cent MR + VP −, 0·7 per cent MR − VP +, and only 6·7 per cent citrate + and indol −. He admits that the samples of soil were not absolutely free from the possibility of contami-

nation, but adds that this possible source of error does not explain the fact that so many of the soil organisms were of an intermediate type, viz., MR + VP −, citrate +, indol −. He concludes that in the conditions obtaining in Shanghai the citrate and indol tests are both useful, but the citrate is the better test. Methyl-red and Voges-Proskauer tests are not helpful. He thinks it would be quite safe to regard those bacilli which grow in citrate and do not produce indol as non-fæcal. It is curious to note that Hicks found *B. typhosus*, *B. paratyphosus* A, *B. dysenteriæ* Flexner, and *V. choleræ* gave no growth in citrate, while *B. enteritidis* Gärtner, *B. paratyphosus* B, *B. suipestifer* and *B. fæcalis alkaligenes* grew well in from two to four days.

J. Taylor has compared the results of Clemesha's method and the test of citrate utilization as applied to the water supplies in Burma. It is difficult to decide on the value of the presence of lactose-fermenting bacteria of the colon group in tropical water supplies, because if the standards which are adopted in temperate climates were applied in the tropics most sources of supply would be placed under suspicion, if not at once condemned. The assessment of the value of the members of the coli group as indicators of pollution of water supplies is therefore of peculiar value in these circumstances. It will be remembered that Clemesha divided the organisms in question into three groups according to their rate of disappearance from water supplies. He regarded the presence of members of the first group as an indication of recent and, therefore, dangerous pollution; members of the second group as indicative of more remote pollution; and members of the third group, the very persistent class, as of no significance from the point of view of contamination of water supplies.

Taylor and his assistants tested the relative value of Clemesha's classification and of the MR and VP and citrate tests when applied to Burmese water supplies. They conclude that all these tests are useful, and that the MR, VP and citrate must be regarded as supplementary to Clemesha's classification, which when used alone yielded results reasonably in accord with the sanitary survey of the water supplies. They find that the presence of MR + and VP −, citrate −, organisms cannot be regarded as evidence of dangerous pollution. On the whole the proportionate number of citrate negative organisms corresponded fairly definitely with the sanitary circumstances.

As regards water supplies in this country, Houston considers that the *B. coli* test still remains supreme. He says typical *B. coli* (lactose +, indol +) is present in enormous numbers in excremental matters and is absent from, or present in small numbers in, substances free from undesirable pollution. The typical *B. coli* is a decadent microbe when divorced from the animal body and its presence in water in any number points to fairly recent pollution. Even so lenient a standard as no *B. coli* in one cubic centimetre of water in a majority of representative samples

implies that the supply is not habitually contaminated with one gallon of sewage in 100,000 gallons of water, no *B. coli* in 10 cubic centimetres and 100 cubic centimetres connote the absence of 0·1 and 0·01 gallon of sewage in a like volume of water. The *B. coli* test, even alone, is of the greatest value, but a water supply should be finally judged on a summation of verdicts (geological, topographical, physical, bacteriological and chemical).

Thompson in a paper on the irregularities in the test for *B. coli* in water has pointed out that when examining Ontario water at certain seasons of the year, particularly October to April, when the water is badly polluted, a presumptive positive lactose tube will give no aerobic colonies when planted out on solid media. It appears that during the growth of colon bacteria in standard lactose broth, a H-ion concentration fatal to this group of organisms may be produced. The life of *B. coli* in carbohydrate media is comparatively short and the pH produced during the growth is the determining factor. Chambers found that a lethal acidity was produced in 0·4 per cent glucose, but growth continued in 0·3 per cent. Experiments were carried out to see if the death of the colon group could be prevented by buffering the medium with dipotassium phosphate. Thompson found that by adding 0·2 per cent of K_2HPO_4 to the standard lactose broth tube the number of positive results was greatly increased. From 300 standard broth tubes he obtained only 166 positive results, but with 300 similar tubes containing 0·2 per cent K_2HPO_4 he obtained 232 positive results.

Bronfenbrenner and Schlesinger have also shown that the amount of gas produced during the fermentation of lactose varies inversely with the H-ion concentration, other factors being equal, and directly with the concentration of the buffer.

Instead of buffering the medium attempts were made to reduce the lactose, but it was then found that alkali-producing organisms grew vigorously and with relatively unpolluted waters; broth tubes with low lactose content were less sensitive as presumptive tests.

In 1927, Salle described a medium for the differentiation of typical *B. coli* from the *aerogenes* group. He says a medium is required in which *B. coli* will grow and produce a maximum acidity of pH 5·0 to 5·4. *B. aerogenes* will produce as much acid as *B. coli* given sufficient carbohydrate. If the sugar is only just sufficient for *B. coli* to produce a final pH of about 5·0 then it will produce more acid than *B. aerogenes*. The medium is well buffered with K_2HPO_4 and KH_2PO_4 and no adjustment of reaction is required as this is controlled by the buffer salts. The indicators are erythrosin, methylene blue and bromcresol-purple. Of this medium *B. coli* produces brilliant metallic colonies which do not coalesce; while the agar surrounding the colonies changes from a purple to an orange tint. *B. aerogenes* produces colonies which are non-metallic, convex, moist and tend to coalesce; the medium around the colonies is not changed in colour.

The isolation of pathogenic microbes such as the *B. typhosus* from raw water is a matter of considerable difficulty. In his second research report

Houston gave the negative results of a prolonged search for the typhoid bacillus. He examined 156 samples of raw water and though he subcultured 7,329 colonies not one proved to be the typhoid bacillus. In his fifth, seventh and ninth research reports the matter was further dealt with. He added typhoid bacilli, "1·172 per cubic centimetre," to raw river water and recovered "10·6" bacilli from the centrifugalized deposit of 500 cubic centimetres of the infected water. As a result of his experiments he thought that if one typhoid bacillus was present in nine cubic centimetres of water it could be recovered. He found that enrichment methods in liquid media were only of value in special cases and that it was best to plate out the material on *solid* media and subculture a large number of colonies. Ox-gall and brilliant green compared unfavourably with the malachite green method.

In his Twenty-first Annual Report for 1927 just issued Houston states that he has reinvestigated the subject, but instead of the typhoid bacillus he used a paratyphoid B culture. He employed a peptone lactose dulcite bile-salt liquid medium of double strength and cultivated from 10 to 100 separate ten cubic centimetre tubes of the infected water. He infected Chelsea filtered water, pure and mixed with one and ten per cent raw Thames water, with paratyphoid B bacilli varying in number from "0·042" to 3 per 10 cubic centimetres of water. From the pure Chelsea water and that containing one per cent of Thames water he succeeded in isolating the B bacilli even when the number was only "0·48" per ten cubic centimetres. From the most polluted water containing only "0·08" B bacilli per 10 cubic centimetre he recovered para B bacilli by adding alumino-ferric, 5 parts per 10,000, to 1,000 cubic centimetres of infected water, centrifugalizing the mixture and plating the deposit on sixteen rebipeslagar plates, containing 1 in 10,000 malachite green. But he had to pick off from the plates for study from 162 to 250 colonies—a most laborious undertaking.

From crude sewage, the usual source of infection of water supplies associated with outbreaks of typhoid fever, Houston has been unable to isolate the typhoid bacillus. Most of the samples were of London (Barking), or Hendon sewage, but individual samples of Dublin, Belfast, Edinburgh and Aberdeen sewage were also examined. He found that it was practicable to work with only about 0·01 cubic centimetre of sewage, which he spread over ten to twenty special plates and made therefrom 200 to 400 primary cultures. Not one of 23,353 colonies studied gave the characteristics of the typhoid bacillus. He then infected samples of sewage with typhoid bacilli, the average number being 268 per 0·01 cubic centimetre of sewage. From these infected samples he was able to isolate the typhoid bacillus, the maximum number being 118 per 0·01 cubic centimetre of sewage and the minimum one per 0·01 cubic centimetre. From these experiments he arrives at the conclusion that there could not have been one typhoid bacillus in 0·00066 cubic centimetre of the crude sewage.

This year Wilson has made use of a glucose-sulphite-iron-bismuth-brilliant green medium for the isolation of *B. typhosus* from raw sewage with most encouraging results. He says that the efficiency of the medium depends on two original observations made by him: (1) The *B. typhosus* in the presence of a fermentable carbohydrate is able to reduce a sulphite to a sulphide, and so to form a black colony in the presence of an iron salt; (2) bismuth sulphite in the presence of a certain excess of sodium sulphite suppresses the growth of most coliform bacilli; in the presence of brilliant green the selective action is intensified. When 0·5 to 1 cubic centimetre of sewage is poured over the surface of a plate of the medium and allowed to dry, and is then incubated for twenty-four hours at 37° C., black colonies with a metallic halo are developed, and also light green colonies of *B. proteus*. All the black colonies are non-lactose fermenters, but Wilson found that a considerable number of the colonies simulating *B. typhosus* were saccharose fermenters, which, by the use of saccharose in a modified Endo medium, could be distinguished from those of *B. typhosus*. Wilson says that the principal organism forming the black colonies is present in most specimens of sewage, but so far he has not found it in fæces. He calls this organism the *B. effluviei*; its chief characters are: Gram-negative bacillus, liquefies gelatine, methyl red negative, Voges-Proskauer positive, grows in citrate medium, ferments glucose, mannite, saccharose but not lactose. It is probably related to the *B. proteus* group.

Wilson examined crude fresh-screened sewage taken from the combined sewage of the upper and lower level sewers of Belfast. On February 16, 1928, he planted out 4 cubic centimetres of sewage and found four typhoid colonies. On February 25 from 11 cubic centimetres he obtained two colonies; on March 8 from 10 cubic centimetres seven colonies; and on March 12 from 5 cubic centimetres eight colonies. The bacilli were not uniformly distributed in the sewage, some of the plates yielding no colonies and others several. Wilson believes that at least one typhoid bacillus is present in each cubic centimetre of the ordinary crude screened sewage of Belfast.

The medium invented by Wilson opens up a new field of research; it should help us to decide on the relative importance of direct infection from carriers, and of infected water supplies contaminated with sewage. Of late years, partly owing to the difficulty of isolating the *B. typhosus* from presumably infected water, there has been a tendency, especially in the tropics, to regard the "carrier" as the most probable cause of localized outbreaks of typhoid fever.

Clinical and other Notes.

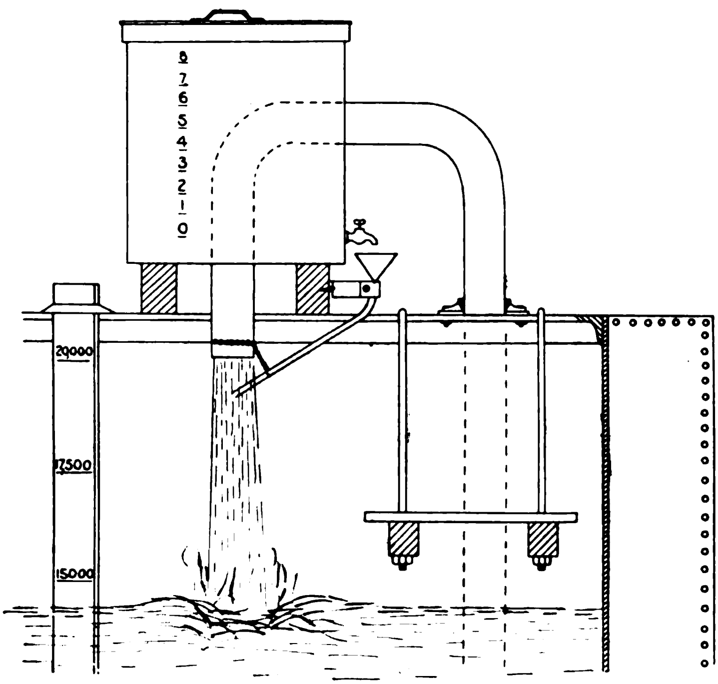
A SIMPLE METHOD OF CHLORINATING WATER IN CAMP.

By Major E. W. WADE, D.S.O.
Royal Army Medical Corps.

and

Lieutenant H. P. CAVENDISH.
Royal Engineers.

At Kutwa Artillery Practice Camp, near Allahabad, a piped water supply was installed this year by the Royal Engineers. The source was a large pool on the Kuardani stream. The intake, protected by a fine-meshed wire gauze rose, was about fifteen feet out from the bank. The water was then



Kutwa Camp chlorinating plant. (Not to scale.)

pumped by means of a petrol-driven engine and pump, through a quarter of a mile of four-inch piping to an elevated tank in the camp.

This tank had a capacity of 20,000 gallons and was raised thirty feet above the ground. It was a single compartment and it was not possible to divide

it. A gauge graduated in feet and inches and into 2,500-gallon units was fixed inside this large tank.

Installed on a stage across one corner of this tank, near the rising main, was an eight-gallon "receptacle, filth, large," graduated into gallons, which had been burnt out and painted with anti-corrosive paint before it was taken into use.

This small eight-gallon tank was fitted with a tap which discharged into a funnel soldered to a copper pipe eighteen inches long, the lower end of which delivered into the centre of the discharging stream of water from the rising main.

A Horrocks' test was done on the water as it discharged from the rising main and showed the water to be a "two-scoop water," i.e., sixty grains of bleaching powder per hundred gallons. Each gallon in the small tank, therefore, should contain at least three ounces of bleaching powder, and would chlorinate 2,500 gallons in the large tank.

At a suitable hour in the morning, usually 6 a.m., the water duty orderly filled the small tank with eight gallons of bleaching powder solution, containing three ounces of powder per gallon. He then signalled to the driver of the engine, who was visible from the top of the tank, to start pumping, and for every 2,500 gallons of water entering the large tank, one gallon of bleaching powder solution was run in. This mixed with the water as it came out of the rising main, and was allowed half an hour's contact in the large tank before any water was drawn off. The chlorinated water, drawn off from any of the numerous taps in the camp, always showed free chlorine.

It took four hours of pumping to completely fill the tank, but by pumping two or three times a day it was never allowed to get empty; so that after the first filling water was always available.

There were no complaints about excessive chlorine in the water, and the M.O. in charge of the camp this year, who was also in charge last year, was delighted with the arrangement, and said it was a great improvement on the three surface wells and tanks on Army Transport carts that were in use last year. Tests were made frequently of the water after chlorination, and invariably showed free chlorine.

There were two brigades of artillery and an ammunition column in camp for approximately six weeks.

Note.—Horrocks' test must, of course, be carried out on the raw water whenever a fresh container of bleach is used, as the amount of free chlorine varies in each sample. The amount of bleach required is then obtained by a simple arithmetical calculation similar to that described above.

STERILIZATION OF WATER BOTTLES BY MEANS OF THE LELEAN SACK.

By Major A. C. HAMMOND SEARLE, M.C.
Royal Army Medical Corps.

In a recent issue of *The Medical Officer* (December 24, 1927, p. 281) there appeared an account of some experiments on the practical sterilization of milk bottles, conducted by Dr. I. N. Sutherland, for the Department of Public Health, University of Edinburgh, using an apparatus modelled on the Lelean sack disinfector. The following is a short résumé of the article:—

(1) A wooden stand was constructed, having four vertical side supports of suitable height for the particular sack in use, with three horizontal circular trays placed thirteen inches apart. Each tray was pierced by four round holes 3½ inches in diameter.

(2) The milk bottles were inserted in an inverted position into the holes for sterilization in that position by downward displacement of steam.

(3) A cylindrical steam-proof canvas container, into which steam was led in at the top and open at the foot, was then lowered over the above-mentioned stand and bottles.

It was found by actual experiment that there was a considerably quicker rise in temperature in an inverted bottle than with an upright bottle. The difference in temperature between the two bottles was most marked during the first 3¾ minutes, at which time it amounted to no less than 37·5° C., and then rapidly diminished.

It will then be apparent that by inverting bottles any organisms in them will be exposed for a longer time to a higher temperature, and that therefore the inverted position is preferable. The author explains the reason for the above, which is, of course, that "Steam (sp. gr. 9) is lighter than air (sp. gr. 14·44). The bottle full of the heavier cool air is surrounded by a lighter atmosphere of steam at 100° C. When the bottle is inverted, the steam forthwith displaces the cold air, which pours from its mouth, but, when upright, steam tends to form a layer above the imprisoned cold air, which it only slowly penetrates by diffusion and the influence of currents."

The optimum position of the bottles having been determined, a large number of organisms, both non-sporing and sporing, were cultured and used for "contaminating" the bottles.

Various methods of testing the effects of steam by downward displacement on the various micro-organisms were tried, and need not be described in detail. It is sufficient to refer to the "bottle" method, in which the bottles themselves were "contaminated or coated" with micro-organisms (one to three cubic centimetres of a broth culture or saline emulsion).

The results are of general interest, as showing the extraordinary efficacy

of sterilization by downward displacement of steam in such an apparatus as the Lelean sack.

It was found, in short, that cultures of mixed pyogenic cocci: *B. dysenteriæ* (Shiga and Flexner), *B. paratyphosus* A and B were sterilized in thirty seconds after exposure. Sporing organisms such as *B. anthracis* and *B. subtilis* were sterilized in four to five minutes.

The upper limit was not definitely reached, but *B. sporogenes* required fifteen to twenty minutes. It should be noted that the "time of exposure"

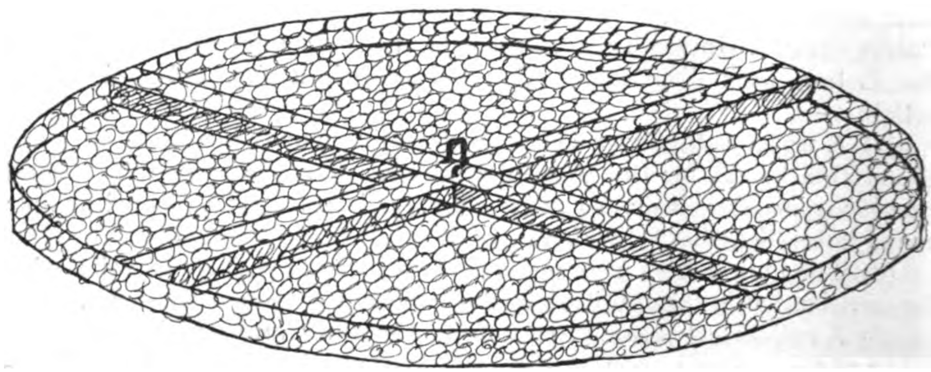


Fig. 1.

was measured from the moment when steam began to emerge from the bottom of the container.

Owing to the success of the above experiments, the question suggested itself whether the method might be applicable to the sterilization of water

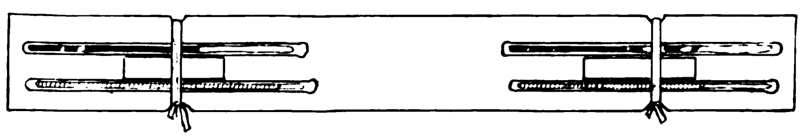


Fig. 2.

bottles. Individual water bottles can be sterilized in a variety of ways, but an outbreak of cholera or other comparable emergency may point to the advisability of sterilization of all the water bottles of a unit, and, in such circumstances, a method which is both trustworthy and rapid has much to commend it.

The Lelean sack with which the experiments were carried out measured four feet in length with an internal diameter of twenty inches.

It was found that, when packed in various different ways, a total of 100 bottles could be taken, leaving an ample margin for turnover, and the insertion of one, or preferably two, blankets, in order effectually to close the bag

and conserve heat. In actual fact the limited number of bottles available only permitted two layers to be arranged, and all experiments were conducted by altering the position of the contiguous layers of bottles, the remainder of the sack being stuffed with blankets.

It was considered that each row of bottles (except that which before inversion was the bottom one) would, after inversion of the sack, be subjected to a good deal of weight from above tending to press the open neck of one bottle firmly on to the felt covering of the bottle below it, and that, consequently, there might be considerable obstruction to the entry of steam.

In order to obviate this, the device shown in fig. 1 was improvised, A strip of iron $1\frac{1}{4}$ inches wide was riveted together in the form of a circular hoop of just under 20 inches diameter, and supported in that shape by means of a cross piece of wood. The whole was then covered on both sides with chicken netting. This enables bottles to be arranged in layers without obstructing the entry of steam.

In order to ascertain the temperature obtained inside the bottles, the following devices were used :—

(1) Témoine tubes melting at (*a*) 80° C., (*b*) 100° C., were prepared, and were fixed in couples on to strips of cork, as shown in fig. 2. These were inserted into a number of water bottles so as to indicate the temperatures at each end of the bottle.

(2) A "water bottle" wide enough to take a maximum and minimum thermometer was improvised from a copper container for sterilizing small size Petri dishes, around which was sewn a double layer of blanket material (to represent the felt cover of a water bottle). A lid was improvised from tin similarly protected with blanketing, and a hole left to represent the neck of the water bottle.

(3) Phipson's Electrical Indicator (described in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, p. 359, vol. XLVI, July 1926) was inserted between the uppermost layer of bottles (before inversion) and the final blanket.

The principle of this device, it will be remembered, is that an electrical circuit is prevented from being completed by inserting a small bar of alloy transversely across and through a hole in a metal plunger. As soon as the alloy melts at the appropriate temperature, the plunger is pulled back by a strong spring, contact is made, and an electric bell is rung.

Control experiments were first carried out in order to determine that the Lelean sack was working efficiently. It was loaded with twenty-two blankets, and Témoine tubes (80° C. and 100° C.) were inserted at the top, middle and bottom, while Phipson's apparatus was introduced just under the last blanket. Steam issued in twenty-two minutes. The Phipson apparatus rang the bell in a few minutes after this, and on examination all Témoine tubes were found "gone," i.e., stained with the contained dye (proving that a temperature of 100° C. had been reached).

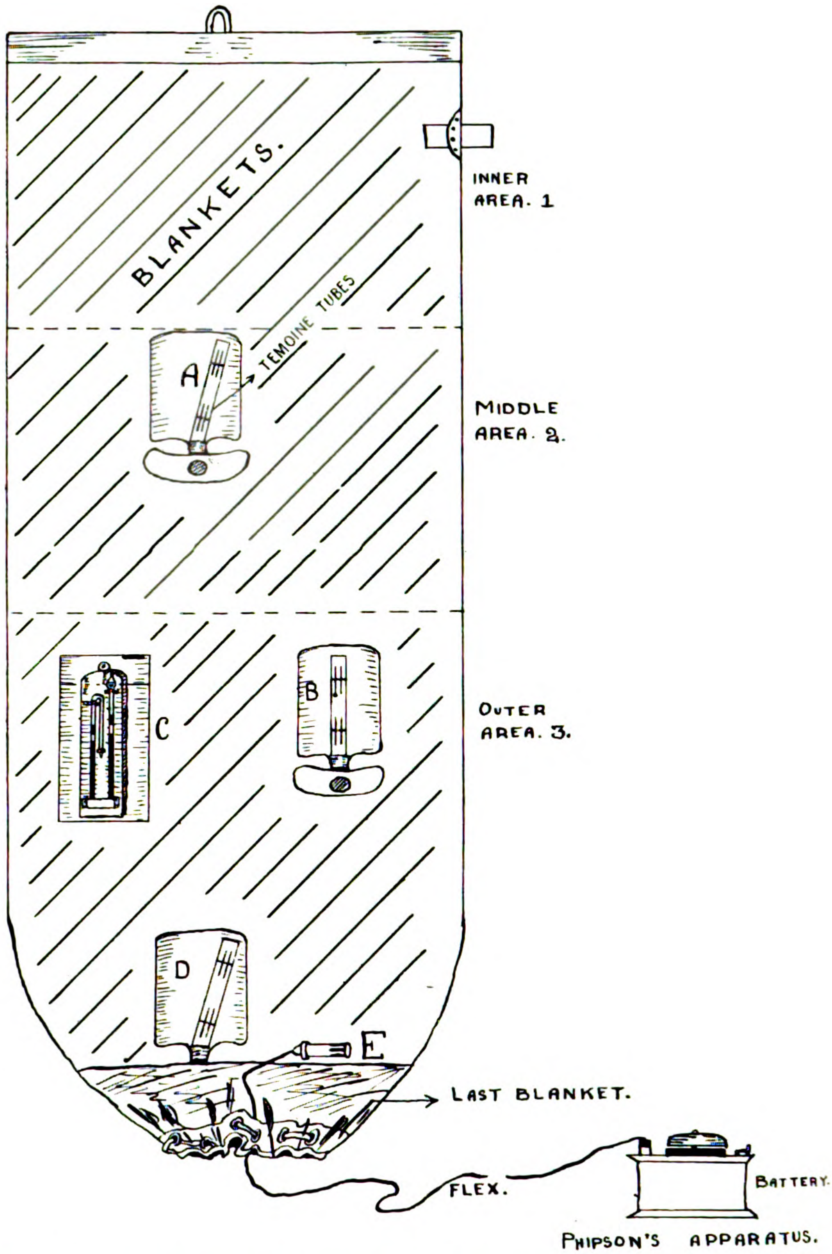


FIG. 3.—A, two water bottles in contact at level of junction of inner and middle areas and containing Témoine tubes. B, two water bottles in contact in outer area and containing Témoine tubes. C, improvised water bottle holding maximum and minimum thermometer. D, one water bottle in contact with last blanket only, and containing Témoine tubes. E, Phipson's apparatus covered by last blanket only.

Note.—Témoine tubes shown too small should be as in fig. 2—testing temperature at both ends of bottle.

As sufficient bottles were not to hand to fill the whole sack with five rows, it was decided to work with a small number of bottles distributed in couples at various places and levels in the sack, and kept in position by blankets tightly stuffed around them. It was necessary first to ascertain whether close apposition of the neck of one bottle to the felt covering of another resulted in failure of the steam to penetrate into the interior of the bottle, and bottles were therefore wedged together as firmly as possible. It was found that it was easier to fix them firmly in position if, whilst the sack was being packed, one bottle was arranged in an upright position and a second packed transversely and firmly across the neck of the first. Témoine tubes fixed on to cork strips (as previously described) were inserted into each of the vertically placed bottles.

After completing the packing and inverting the sack, the bottles and temperature apparatus were distributed as shown in the diagram (fig. 3).

All bottles and apparatus were kept in position by packing blankets (twenty) around them.

Results of Experiments.

Experiment 1.—Lelean sack very badly manipulated. Lamp went out several times. All Témoine tubes melted, but maximum and minimum thermometer only reached 202° F. Steam never issued freely, and Phipson's apparatus failed to ring bell.

Experiment 2.—All Témoine tubes melted. Phipson's apparatus covered with one blanket. Alloy melted and bell rang nine minutes after steam issued.

Experiment 3.—Conditions identical. Steam issued in twenty-two minutes. All Témoine tubes melted. Phipson's apparatus: bell rang seven minutes after steam issued.

Experiment 4.—Conditions as above. Steam issued in twenty-two minutes. All Témoine tubes melted. Bell rang nine minutes after steam issued.

Experiment 5.—Conditions as above. Steam issued in twenty-two minutes. All Témoine tubes melted. Bell rang one minute after steam issued.

Experiment 6.—Conditions as above. Same results. Bell rang one minute after steam issued.

Summary.

All Témoine tubes were found to have been melted on each occasion, and the alloy of the Phipson's apparatus melted (bell rang) in from one to nine minutes after the issue of steam from the bottom of the sack. The maximum and minimum thermometer had reached 215° F.

The variations in time taken for the bell of the Phipson's apparatus to ring indicate that near the mouth of the sack, attainment of the requisite temperature for sterilization is dependent on the way in which heat is

retained by the superimposed blanket. It is clearly advisable to use a second blanket for this purpose, even if some space is thereby sacrificed.

Conclusions.

(1) It is possible to sterilize water bottles to the number of 100 per load in the Lelean sack.

(2) It is not necessary to take special measures to keep them apart, as steam will succeed in finding its way into them however tightly they are packed.

(3) The sack must be closed by at least one, and preferably with several, blankets. Although it is evident that the outermost layers of the last blanket are not sterilized, it has been shown that a temperature of 100° C. is reached just below it.

Travel.

SHANGHAI—SOUTHAMPTON, via CANADA.

By Major F. R. H. MOLLAN, M.C.
Royal Army Medical Corps.

(*Continued from p.* 232.)

Arriving at Field there was just enough daylight left to appreciate the lofty Mount Stephen (10,485 feet) towering 6,000 feet higher than the little town.

Shortly after leaving Field we entered the "Spiral Tunnel," one of the most noteworthy engineering feats in existence. The track enters the first tunnel, 2,890 feet in length, under Mount Ogden (8,795 feet). Turning part of a circle and passing over itself it comes out 45 feet higher up. Crossing the river it enters the second tunnel, 3,206 feet in length under Cathedral Mountain (10,454 feet). Here again it turns almost a complete circle and passing over itself emerges another 48 feet up. These wonderful tunnels have reduced the gradient between Field and "The Great Divide" from 4·5 per cent to 2·2 per cent. The whole thing is a perfect maze, the railway doubling back upon itself twice and forming a rough figure "8" in shape.

Unfortunately it was dark when we passed the "Great Divide," so we could not see it. It is the highest elevation reached by the railway (5,338 feet), is the boundary between Alberta and British Columbia, and the very backbone of the continent. It is marked by a rustic arch spanning a stream which divides. The water that flows to the east eventually reaches Hudson's Bay and the Atlantic; the rivulet that runs to the west adds its mite to the Pacific.

For all practical purposes we had now said goodbye to the Rockies. We regretted not seeing something of Banff—a Mecca for tourists from all over the world—and also Lake Louise, which is said to be probably the most perfect gem of scenery in the known world.

But what a day we had had! Panorama after panorama of varying and surpassing loveliness, engineering feats that took our breath away, and air that would make the gloomiest pessimist glad to be alive!

The next morning found us out on the prairies of Alberta—with just a faint outline of the Rockies on the skyline behind us. "The Limitless Prairie" seems a fitting title for these great expanses—stretching away in even and unbroken leagues to the far horizon. Homesteads are passed here and there—lonely looking little places with the nearest neighbours miles away. One was given furiously to think what "medical arrangements" existed for these hardy farmers, particularly in winter when the prairies are covered in deep snow and communication such as we know it is impossible. A few wild-looking horses cocked up their ears and scampered away at the approach of our train, but otherwise there is no sign of life for mile after mile. Presently, however, homesteads become more numerous and we run into Medicine Hat, a pleasant little town situated on the banks of a branch of the Saskatchewan River. Here we have a welcome twenty-five minutes to stretch our legs and get a glimpse of this busy little town with its electric light, good roads, and modern buildings alongside those of the earliest "frontier" days.

One of the worst features of such a long railway journey is the almost total lack of exercise, and on an average twenty minutes morning and evening was the most we got throughout the five days. The trains also have a little way of quietly stealing out from a station without warning unless one is near enough to hear the conductor's "All aboard," and so one rarely dare venture beyond the station precincts.

This, the second day of our run, was somewhat of an anti-climax after the previous day—mile after mile of hot dusty prairie till we wearied of the monotony and were glad to "pull into" Moose Jaw in the evening for another twenty minutes' break. Moose Jaw is a very go-ahead little place with excellent shops, electric light, etc. We had our twenty minutes' exercise here all right, for my American friend, tired of the heat and prohibition, craved a "drop of the cratur" and rushed from street to street looking for a "hooch-dive." Finally he ended up by asking a policeman, but it was no good and we returned to the train, my friend raving at "pussy-foots" and prohibition laws alternately.

We were now in the heart of the great grain province of Saskatchewan and continuing our journey reached Winnipeg early next morning. We had covered just on 1,500 miles since leaving Vancouver and were practically halfway across the Continent. Winnipeg is Canada's third largest city and is the greatest grain market and grain inspection point in the British Empire. It is the railway centre of Western Canada and

commands the trade of the vast region to the north, east and west (fig. 7). It is beautifully situated at the junction of the Red and Assiniboine Rivers and is, of course, the capital city of Manitoba. As we had a halt of nearly two hours here (the longest of the whole journey) we were able to see something of this great city. We were surprised to find how hot it was, for even before 9 a.m. on this September morning walking made one uncomfortably warm—this in contrast to the bitter winter when a friend of mine had his nose frost-bitten while taking a twenty minutes' walk! A short account of the history of Winnipeg may not be out of place, evidencing, as it does, the extremely rapid growth of these western cities and towns. La Verendrye, the first white man to set foot in Winnipeg, arrived in 1738, and built Fort Rouge, now part of the city. In 1806, Fort

Fig. 7.—Winnipeg.

Gibraltar was built by the North-West Trading Co.; in 1822, when the North-West Company amalgamated with the Hudson's Bay Co., that Fort was rebuilt and named Fort Garry. In 1835 Fort Garry was rebuilt in stone. Though this was an important trading centre for the Western plains, the population of Fort Garry, as late as 1871, was only 215! To-day the population of Greater Winnipeg is 283,100, and the city itself 199,500. The city is handsomely built, one of the most notable structures being the provincial Parliament Buildings; it is also the seat of the University of Manitoba and the Manitoba Agricultural College. Immense workshops of the Canadian Pacific Railway are situated in Winnipeg, and

the railway has also the two largest train yards in the world. One yard has 121 miles of track. The second is even larger, as it includes seventy tracks with a total mileage of 165 miles. In connexion with this yard development the Canadian Pacific has a transfer elevator of a million bushels capacity. These grain elevators are an arresting feature of each station passed in the grain area.

Leaving Winnipeg at 10 a.m., we had by noon passed out of the prairies and were running through a delightful country of woods and lakes. What a relief from the heat and dust which had made the open platform of the observation car (where one could sit and smoke) well-nigh impossible! Halfway between Winnipeg and Fort William is Lake of the Woods, one of the finest tourist resorts in America. This body of water, fringed with unspoiled woods, covers an area of nearly two thousand square miles. Its scenery is distinctly primitive, bold rock and innumerable islands associated with a wealth of forest growth. At Kenora we passed the principal outlet of the Lake of the Woods, where the lake pours its waters into the Winnipeg River by three distinct cataracts. Woods and lakes were passed in an unending panorama until late in the evening we arrived at Fort William. The "twin cities" of Port Arthur and Fort William, situated on the northern shores of Lake Superior, together constitute Canada's greatest grain port. The bulk of the huge grain crops of the Canadian West are hauled hither by freight cars, transferred to lake steamers and carried down the great lakes to Buffalo and other ports. As many as 369,000,000 bushels of grain have passed through these two cities in a year. The total capacity of the thirty-six public terminal elevators is 64,610,000 bushels! Fort William (population 43,000) is situated at the mouth at the Kaministiquia River, and was formerly a very important Hudson Bay Co.'s post, being a great rendezvous of the hunters, voyageurs, and chief factors of the company.

We were now in the Province of Ontario, a province three and a half times the size of Great Britain and twice the size of France, with a population of three millions. Its immense production of minerals, particularly nickel and copper, has already made it world famous; it is rich in timber, and possesses a great clay belt containing many million acres of famous farming land of great promise. Agriculture in this district, however, is still in the pioneer stage. Our journey the next day was continued through a country of woods and lakes, hills and rocks. In this bush country, where rivers and lakes are so frequent, game of all kinds is abundant, moose and red deer being plentiful. Indeed, viewed from the train, it looked a hunter's paradise.

At midday we "pulled into" Chapleau, an important railway divisional centre, and were glad to get another welcome "promenade," if only for fifteen minutes. A curious sensation is experienced on alighting from the train after these long runs—hardly giddiness and more nearly approaching the feeling of being aboard ship—as though the ground was rocking

slightly. At Chapleau is situated the only hospital between Fort William and Sudbury, a distance of 553 miles. Leaving Chapleau we passed quaint little stations with melodious Indian names, Pogamasing meaning "Shallow gravel rapids," Metagama, "A river widened into a lake," Bicotasing, "A narrow filled with waterlilies, connecting two lakes," and Nemegosanda, "The river where the trout live." Presently we passed the high falls of the Vermilion River, creamy, foaming water cascading far below the train, a lovely sight. Towards evening we ran down a valley where there is a stretch of rich farming country unusual in this hilly rocky region, but it was only a temporary break, and we were soon back again amidst the rocks, lakes and woods. Nearing Sudbury, we began to see evidences of the nickel industry, and soon passed the Murray Mine of the British American Nickel Corporation. Sudbury (population 9,000) is in the centre of the world's greatest nickel deposits, a source of incalculable wealth. A belt of some thirty miles by sixteen miles is estimated to contain anything up to five hundred million tons of combined nickel and copper. From mines and smelters in this district the International Nickel Company, the Mond Nickel Company, and the British-American Nickel Corporation ship to their refineries in Canada, New Jersey and South Wales. Sudbury supplies over two-thirds of the world's consumption of nickel. Close by is the immense Moose Mountain Iron Range, which contains one hundred million tons of iron ore. Backed by these tremendous resources, it is not surprising that the streets and buildings of Sudbury are those of a city! Near Sudbury is the junction with the Canadian Pacific main line from Toronto. We had now reached the evening of the fourth successive day of train travel, and were eagerly looking forward to the morrow and the end of our long trans-continental run. We were up betimes next morning, and breakfasted early as we were due in at Montreal at 8.30 a.m. The woods and lakes had given place to what might easily be part of the English home counties, and there is a look of these about the farms set in fields with "hedges"! Shortly before arriving at Montreal, we crossed a large viaduct over the Ottawa River which here joins the St. Lawrence. At Montreal we have to change for Quebec, and so must leave the train which had carried us quickly and punctually 2,885 miles in four days. Unfortunately, time did not permit of our seeing very much of the chief city and commercial metropolis of Canada. Montreal stands on an island formed by the St. Lawrence and Ottawa Rivers, on the site of the ancient Indian village of Hochelaga; and not only enjoys the distinction of being a great ocean port nearly a thousand miles inland, but in point of foreign commerce is the second port of North America. It is 150 miles above salt water, but the mighty St. Lawrence forms a highway upon which ocean-going steamers ascend. The city has a far-reaching trade and great manufacturing establishments; many fine buildings and numerous churches, convents and hospitals. Notre Dame can accommodate 10,000 worshippers, and has been known to have

housed 15,000. Montreal is the largest bilingual city, and the fourth largest French-speaking city in the world; over half the population of Greater Montreal (900,000) speak French as their mother tongue. Prominent from every part of Montreal is Mount Royal, a large and beautiful public park with, nestling in the shelter of the mountains, the famous McGill University. Historically, although it lives so strictly in the present, Montreal is as interesting as Quebec. The village of Hochelaga was visited by Jacques Cartier in 1535, and in 1642 Maisonneuve established a settlement called "Ville Marie." Wars with the Indians, and later wars with the English, did not interfere with Montreal's growth. In 1760 it was the last stand of the French after Wolfe had defeated Montcalm at Quebec.

But our train was waiting to take us to Quebec, another 173 miles by rail. And here we found a feature of railway travel new to us, for by paying a booking fee of 1 dollar we reserved an armchair in what is known as the "Parlor Car." These cars are very comfortable, and are literally observation cars, with armchairs which can be swung round to any position desired.

Leaving Place Viger Station we travelled north across the Island of Montreal, over the foaming waters of the Rivière des Prairies to Ile Jesus, and then in a few minutes to the Rivière des Milles Iles, which is crossed to the mainland. From the bridges magnificant views were obtained; the rivers, which in reality are two forks of the Ottawa River, are broad and swift at this point, with tumultuous rapids and deeply indented, heavily wooded shore lines. From the bridges we got glimpses of vast rafts of logs, some with temporary huts for the lumber men erected upon them. Our route now lay across the lowlands which stretch between the St. Lawrence and the hills. This plain is cut into narrow strips which are, apparently, characteristic of French-Canadian farmlands. There are two reasons for the peculiarly shaped farms. One is that the continual subdivision of bequeathed estates left no alternative, the other is that a water front was absolutely necessary to each farm, so they extended in long strips, thus giving each farmer a narrow frontage on the river. All along one is struck by the conspicuous part the Church plays in village life. Everywhere the church and the presbytery are the most prominent buildings in the compact little villages one files past so quickly.

At last, tired and travel weary, we reached Quebec and the longed-for bath—we were literally black after the long journey! A taxi whirls us off to the Château Frontenac Hotel—at once a perfect hotel and architectural gem. It has been erected on the site of a building far famed in Canadian history, the Château of St. Louis, and the builders have reproduced in every stone the architecture of the eighteenth century (fig. 8).

Quebec (population 120,000) was the birthplace of North America, and with its name are linked those of the heroic priests, soldiers and pioneers who established civilization in the New World. The first white man to visit Quebec was Jacques Cartier, in 1535, but it was not until 1608 that a

city was founded by Samuel de Champlain. For a century and a half thereafter Quebec was the headquarters of French rule in America, contending with the New Englanders for domination. In the middle of the eighteenth century, the destiny of Quebec changed abruptly, for in 1759, at one of the most famous battles in history—that of the Plains of Abraham—the British defeated the French, and four years later were ceded Canada.

We luckily had a whole evening here, and so were able to see a good deal of this romantic city. Disdaining a taxi, we engaged a fiacre, complete with Jehu who might have stepped from a Paris boulevard, and set out to see the sights. The good Jehu proved an excellent guide, and soon passing the fine Parliament buildings we reached the Citadel, and had a fine panoramic view of the St. Lawrence and harbour stretched out below. A

FIG. 8.

few minutes later and we were on the historic Plains of Abraham, with its impressive monument erected to Generals Wolfe and Montcalm. By a curious coincidence not only were Wolfe and Montcalm killed in the famous battle but their respective successors met the same fate in the next engagement. Here was pointed out to us the spot where the British landed and the cliffs they had to scale—a remarkable feat and one that could hardly have been accomplished but for the fact that the French had thought such a mode of approach impossible. Another fine view of the St. Lawrence was here obtained, with in the distance a magnificent bridge carrying the railway across the river. Crossing the Plains of Abraham we viewed yet another fine monument erected to the joint memory of the British and French generals who succeeded Wolfe and Montcalm. Looking northward from here is a fine view of the valley of the St. Lawrence, with the Laurentian Mountains in the background. We were

now in the residential district, and might have been in a town of France itself; but the light was going, and we had to hurry on to see something of the city, which retains much of its old French tradition. The architecture of the city is French, with some buildings of the eighteenth century, others more modern but carefully built in an artistic attempt to duplicate the essentially French strain of the old. The older part of Quebec is indeed quaint, with its steep cobbled streets, confusion of high gabled roofs, its quiet alleys, its convents, churches, monks, inhabitants, leafy squares and its countless statues—all giving an Old World individuality to a city steeped in history and romance. Two great cities, Montreal and Quebec, typifying at once, as it were, two eras in Canada's history, the new and the old—cities of which Rudyard Kipling wrote:—

> "Peace is our portion. Yet a whisper rose
> Foolish and causeless, half in jest, half hate.
> Now wake we and remember mighty blows,
> And, fearing no man, wait."

TRANS-ATLANTIC.

Next day we embarked on the "Empress of Scotland," the Canadian Pacific's premier ship. Here we "took over" again our heavy baggage which had come safely across the continent as though by magic—another instance of the thoroughness and thought for the comfort of passengers which is so typical of the greatest transportation company in the world.

Large crowds had assembled at the quay to give a hearty send-off to T.R.H. the Prince of Wales and Prince George, who were returning by the "Scotland" following their Canadian tour.

We were forty-one steaming hours (nearly 1,000 miles or a third of the voyage) on the St. Lawrence. So wide is the river that we had soon lost sight of its banks and might have been in the open sea. Indeed, this was the worst part of our journey, for here we came in for the tail end of a bad storm, though the Atlantic itself proved calm as the proverbial millpond.

Cherbourg was reached on the morning of September 14, and that afternoon found us steaming up Southampton Water under dark clouds and a scurry of rain.

Coming up the Solent we could see in the distance at Spithead the "Nelson" and "Rodney," and some of our Canadian companions seemed faintly amused at the interest and excitement we showed in seeing these mighty ships for the first time. Smiles, however, turned to interest when we explained what these two vessels stood for—the Navy that protects the trade routes to and from the Dominion, not alone Atlantic but Pacific!

Southampton at last—we had covered roughly 11,500 miles since leaving Shanghai, had crossed two oceans and a mighty continent, and, incidentally, completed a circle of the world.

TRAVELLING WITH TROOPS IN INDIA.

By Major J. E. M. BOYD, M.C., F.E.S.
Royal Army Medical Corps.

For the first time in nineteen years' service, I experienced the joys of bringing down a party of troops from the Hills. On the whole the trip was amusing, and a few details may prove of interest to the readers of the Journal of the Royal Army Medical Corps, as the experiences were fairly typical.

My permanent station at the time was Ferozepore, in the Punjaub, and I was directed to proceed to Dagshai, Simla Hills, to bring down a party of British infantry from the latter to the former station.

Two routes were open to me when going up to Dagshai; a shorter, via Ludhiana to Kalka, or a longer journey, involving two changes, one at Raewind and the other at Lahore, which was more convenient.

As the route via Ludhiana entailed leaving at 4.13 p.m., arriving at Ludhiana at 9.25 p.m., and waiting there until 12.35 a.m., I decided to pay the extra fare and travel via Lahore.

This meant that I had to commence my journey two hours earlier, with a wait of forty-five minutes, actually one and a half hours, at Raewind, and another wait of about two hours at Lahore.

The advantage of this route was that the Kalka train left Lahore at 8.45 p.m. and reached Kalka at 6 a.m., without a change in the middle of the night, and as the train started from Lahore, one was able to obtain a seat and "bed down" with every prospect of passing a more or less comfortable night in the train; also a very reasonable meal could be obtained at the dining-room at Lahore station.

I was fortunate in being able to find an empty coupé at Lahore, and after securely fixing every means of ingress to the compartment, I went to bed and, except for the energetic attentions of one or two bugs, now deceased, spent a fairly comfortable night, though my sleep was frequently broken by the cheerful voices of the "Matai wallahs" and the gentlemen desirous of disposing of "Hindoo pani" and other such aids to health.

After taking "chota hazri" at Kalka, I was again lucky enough to obtain an empty compartment in the Kalka-Simla train, and proceeded to Dharampore.

Though very small, the carriages on this line are fairly comfortable, being intended chiefly for the conveyance of the "heaven-born" and other exalted personages to and from their summer paradise at Simla.

One amusing point is that the first and second class carriages are identical and become either first or second class at the will of the guard, who has simply to turn a small board over the door of the compartment to alter the class. This system is simple and reduces rolling-stock, but is

liable to raise suspicion regarding additional passengers in the minds of those entomologically inclined.

The Kalka-Simla railway is a wonderful piece of engineering work, winding, as it does, along the hill-sides and gradually rising up to Simla. On one hill-side it is possible to see two sections of the line over which the train has recently passed directly below one. The track is of narrow gauge, and except at stations is for the most part single.

After a journey of about two hours, Dharampore, sixteen miles from Kalka, was reached, and a tonga was taken up to Dagshai, about three and a-half miles away.

On arrival I was told that I was not expected, as, owing to the small number in the party, it was thought that an assistant surgeon would have been sent up to take over medical charge during the move, but immediate steps were taken as regards my comfort and for my accommodation on the downward journey. I was told that the party was not leaving until the day following that mentioned in my orders.

Luckily, I had several friends in Dagshai, and was very kindly put up by my old friend Major W. R. Durham., I.M.D., retired, the local executive officer. I was very pleased to renew the acquaintance of many friends of the previous year, during which I had acted as Senior Medical Officer to the station and had held command of the British Military Hospital.

I need not give a description of Dagshai here, as this was published in a previous article of mine in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS. I need only say that the weather was fine and the views excellent.

Two trains had been arranged for at Dharampore for the downward journey ; the first, with the baggage, left at 1 p.m. ; the second, with the troops, at 2 p.m.

Not being very fit I asked for a pony for the trip from Dagshai to the railway station, but a rickshaw with four coolies was sent instead.

On a steep part of the road the rickshaw "ran away," and on going round a corner skidded badly and nearly upset ; luckily the two coolies forming the rearguard were alert and so saved the situation and myself. I arrived at the station at 12.50 p.m., according to plan, and was in time to see the baggage train leave at 1 p.m.

The officers detailed for the second train had lunch at the railway refreshment room. It was a strange meal, more like "brunch" than "lunch." We began with soup, followed by mutton chops with a particularly strong flavour, which seemed to indicate that if the mother of the animal from which the chops had been obtained was a sheep, she must have been very lax in her morals, have strayed from the fold and finally had an assignation with a billy-goat. The third course consisted of eggs and bacon, with tinned pineapple to follow. Tea was served as a beverage, though one or two preferred bottled beer. On the whole the meal was much better than was expected, the room and its contents were clean and the service good. The presence and marked friendliness of several rats, how-

ever, seemed to indicate that a "rat week" was unknown, or at any rate forgotten by these rodents.

By the time we had finished lunch, the second train had been drawn up at the platform; some of the carriages were fairly new, or had at any rate been recently painted; others were the reverse. There were two carriages near the brake van; each consisted of one first class and one second class compartment; each first class compartment was intended to carry five passengers, but we decided that if both seats were occupied it would be impossible to move our legs, owing to much space being taken up by "hand" luggage, so the O.C. party and myself took one compartment and three junior officers the other.

One officer had already gone on in the baggage train, and when last seen was sitting on the floor of the guard's van, with his feet on the step, this being the only vacant space he could find; it is pleasing to state that he was found intact on our arrival at Kalka later in the afternoon.

One second class compartment was given to the warrant officers and the other reserved as a hospital. As the latter was a saloon compartment with lateral seats, the orderly in charge was probably the most comfortable passenger on the train, at any rate he was asleep whenever I looked into the compartment.

The troops were given third class accommodation and, though somewhat overcrowded, had much more room than the baggage party in the first train, who, although they had sufficient seating space were crowded out by an accumulation of packs, rifles, dogs, and one small peaceful cat, which during the march down from Dagshai had sat quietly on the top of its owner's pack.

Every one was cheerful, possibly at the prospect of no more "khud hopping," which seems to be the chief aversion of a certain class of soldier stationed at hill stations.

One third class compartment was allotted to officers' servants. One particularly offensive menial, category uncertain, took possession of one compartment of the same carriage and packed into it numerous women and children, said by him to compose "my family, sahib." He and the so-called family were ejected after considerable difficulty, together with much of his kit. I am still rather doubtful if he had any claim to travel on the train at all.

Numerous followers tried to get into the train from the "off" side; these were finally overcome by the regimental police and were ordered back on to the platform.

When the train left there remained on the platform a large, noisy and unpleasant smelling crowd of so-called followers for whom no space was available on the train. It is wonderful on these occasions to see the vast number of natives who consider that they have a legitimate claim to a free trip. In addition to the recognized followers, with their wives and families, there are numerous relatives, brothers, fathers, uncles, aunts, cousins to

the "N'th" degree, and unrelated friends, who turn up and claim the benevolence of the Government.

About half an hour after leaving Dharampore the train stopped suddenly and one of the railway servants was seen to go between two of the carriages with some string in his hand; after a short delay he reappeared, minus the string, so presumably he had repaired the damage and our lives were no longer endangered.

A short time later the train again stopped; the defect appeared to be between a different pair of carriages, but after the application of more string we were able to proceed and eventually reached Kalka without further mishap.

The unloading of the baggage train was in full swing when we detrained, and we were relieved to see that the baggage officer had arrived safely. The methods employed in unloading were worthy of the best efforts of the world-famous American "baggage smashers"; undoubtedly the most easy way to unload heavy baggage from a truck is to pull, roll or push the various packages to the edge of the truck and allow them to drop to the ground.

Whenever possible, that is to say whenever strict supervision was not maintained, these methods were employed, and it is to be hoped that the contents of the boxes were unbreakable, though judging from some of the results the boxes themselves were not made to resist such energetic handling.

When unloading was completed, rations "Scale S" were issued to the troops, and here there seemed to have been a slight misunderstanding on the part of the I.A.S.C. agent, concerning whom I had heard previous reports.

Each man was supposed to receive eight ounces of bread, one ounce of butter and two ounces of jam. On examining the rations it was found that each man was to receive two slices of bread; on one slice of bread there was the most minute scraping of butter, with a similar quantity of jam on the other slice. On weighing one such ration it was found to be three ounces underweight, and when weighed in bulk the total weight of the rations was seventy pounds or nearly one-third under what it should have been. A voluminous correspondence, so dear to the Indian babu, was anticipated regarding this trivial error of judgment.

Whilst waiting for the baggage vans to arrive we watched the entraining of the horses belonging to H.E. the Viceroy—they were magnificent animals, by far the best of their class I had ever seen in India. The larger horses gave little trouble, being evidently used to railway travelling, but two small ponies, which formed the tail of the string, caused much commotion and strongly objected to entering their respective horse boxes; eventually the smallest was lifted bodily by several coolies and so placed in its box.

I do not know who was in charge of these horses, but, although I have

seen a large number of horses, mules and camels entrained at various times, I have never seen anyone handle horses in so quiet and gentle a manner as was employed by the gentleman in charge. One horse held back at first, and instead of the intensive shouting, swearing and waving of arms usually associated with such occurrences, there was almost silence, just a tap on the horse's flank, first with a topee and then with a small stick, and the horse entered the box without any further trouble.

When all the baggage had been loaded on to the broad-gauge vans, the men were ordered to entrain.

The rolling stock provided comprised one composite first and second class coach and several third class coaches. The usual troop train was being used elsewhere, and so was not available.

The composite coach consisted of two first class compartments, each with four sleeping berths, two second class compartments to sleep five each, and two servants' compartments to hold apparently as many as could squeeze in.

These compartments were allotted as follows: First class to officers, one second class to warrant officers, and the other for use as a hospital, officers' servants being told to occupy the servants' sections.

A slight complication now arose; the wife of one of the officers, with a small infant and nurse, arrived by the Simla train, so naturally the officer wanted to take her with him on the train. As she had a first class ticket the local railway authorities had no objection to this, but the question arose as to how she was to be fitted in. After a little discussion it was arranged that one first class compartment should be handed over to the officer and his wife; this left five officers for the remaining first class compartment, so the hospital compartment was taken over by the O.C. party and myself, on the understanding that should it be needed for its legitimate purpose we would turn out and get into one or other of the first class compartments. A third class coupé was handed over to the nursing orderly as a sleeping place for himself, much to his disgust, as the seat had no cushions.

The present arrangements for the wives and families of officers travelling with troops to and from the plains are, from the point of view of the parties concerned, very unsatisfactory; every one will, I think, agree that India is not a country in which white women and children should travel alone, and it would be highly appreciated by all married officers, so employed, if some special accommodation could be provided on the troop trains to enable their wives and families to travel on the same train, of course, on payment of the usual fares, or, better still, if the railway authorities could be induced to allow them to travel on a "Form E."

In the case in question the lady had her ticket and all was well, and as her husband has recently passed the Staff College course, perhaps at a later date, when he has reached the higher ranks, he may be able to arrange for some such scheme as is suggested above to be sanctioned, so that all junior

officers at a later date may, with their hands before their faces, pray for his long life and prosperity, though it is not anticipated that they will claim him as their "father and their mother."

As the troops were overcrowded an extra third class carriage was asked for and was supplied at once by the station master, who did everything he could to make every one as comfortable as possible.

The real excitement of the day commenced when the "followers" were ordered to entrain. The official number of these was forty-two, and a third class carriage to hold thirty-two was set aside for them. By the time the gate was opened to admit them to the station the majority of those left behind at Dharampore seemed to have arrived at Kalka, probably by road, and the whole platform became a mass of struggling and fighting humanity.

Each man seemed to possess at least one wife, several children, two or three huge bundles of bedding and cooking pots, all of which had to be taken into the carriage; in addition there were uncountable "hand butties," empty kerosene tins, sticks, indescribable dogs, and one parrot.

The followers swarmed into the carriage; some sat on the seats, others on the floor, they pushed, fought and swore, speed being added to their efforts by calling out that the train was going to start at once.

I rescued one better type of dog from the mêlée and handed it over to a B.O.R., who took it into his compartment. Finally one had to become serious, and I said it would be absolutely dangerous to life to allow any more followers to entrain; the "Black Hole of Calcutta" must have been Paradise compared with the conditions in the carriage.

As many genuine followers had been unable to fight their way into the carriage, more space was needed. An empty goods van was standing just in front of the train, which it was thought had been provided for the kits of some of the married families, who were following later by mail. Luckily this was not used for the surplus followers, as it appeared to be an all-metal truck, which when closed would be more or less air-tight; and, as the baggage officer said the doors would have to be locked before starting, there would not have been sufficient ventilation for the number of persons still needing accommodation, and one did not wish to have to complicate matters by having to detrain a number of corpses at the end of the journey. Later it was discovered that the van had been provided for the kits of officers from Army Headquarters who were going to Delhi, so it is perhaps just as well it was not "jumped" by the unit.

Eventually one compartment of the extra coach supplied for the B.O.R.'s was filled with selected Indians, known to be legitimate followers.

It may appear that there was considerable lack of control as regards the entraining of the followers, but any one present would fully realize that it would have taken a large picquet to control the mob, and as the matter concerned the railway authorities more than the military, things went as they did.

When the station had regained its normal peaceful condition, the officers went to get a meal and much needed drink at the refreshment room.

After dinner a very agitated railway official asked how many followers were included on the warrant, and when told that forty-two was the correct number, he asked: "Sahib, what can I do, there are many more on the train?"

It was suggested that he should take steps to turn out the unauthorized passengers; he saw the joke, many Indians have a keen sense of humour, and replied: "Sahib, it is impossible, I could not get into the carriage." When asked how many he thought were in the carriage, he estimated the number at "about ninety."

Suddenly he had an apparent brain wave and said that he would wire to Ambala and Ludhiana for travelling ticket collectors to board the train and collect fares from all the canteen employees, wives, and other unauthorized persons on the train; how these unfortunate officials were to get into the carriage unless through a window or by cutting a hole in the roof seemed to defeat him; so he went away smiling and, as expected, nothing happened. Eventually all, including the parrot, arrived safely at Ferozepore, and I was able, after the troops and followers had detrained, to get back to my bungalow for a bath and breakfast, after what had proved a not unpleasant and most amusing experience.

Current Literature.

DUDGEON, L. S., and PULVERTAFT, R. J. V. **On Slow Lactose Fermenting *B. coli* in Urinary and Intestinal Infections.** *J. of Hyg.* 1927, v. 26, 285-304. [10 refs.]

The authors summarize the clinical and bacteriological findings in 300 cases of acute and chronic infections of the urinary and intestinal tracts, from which bacilli of the colon type were isolated, distinguished by their slow fermentation of lactose. Most of the cases concerned were of the acute urinary type; and the authors emphasize the severity of the general symptoms associated with such infections, often leading to a mistaken diagnosis of enteric fever. They point out, also, that recovery from acute urinary infection with organisms of this type is usually complete, in contrast to the chronic or relapsing course usually pursued by infection with typical *Bact. coli.* The group of organisms described is subdivided according to the action of individual strains on saccharose and dulcite, and the production of hæmolysis when tested against human red cells. The most numerous and important group, comprising 82 per cent. of the strains examined, produce no change in saccharose, ferment dulcite with the production of acid and gas, and cause well-marked hæmolysis.

Antigenic analysis of the strains isolated was carried out by agglutination, absorption and the precipitin reactions, using for the latter purpose filtrates of broth cultures, which had been incubated for one month at 37° C.

The results showed that serological differences exist which correspond with the grouping based on other grounds. There was, however, some degree of cross-agglutination between members of the various late-lactose-fermenting strains, and typical *Bact. coli.*

It is noted that there appears to be a close relationship between the predominant group of late-lactose-fermentors referred to above and *Bact. columbense* (Castellani).

W. W. C. TOPLEY.

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MCALPINE, J. G., and SLANETZ, C. A. **Studies on the Metabolism of the Abortus-Melitensis Group. 2. Further Observations on Nitrogen Metabolism.** *J. Infect. Dis.* 1928, v. 42, 66-72, 2 charts. [5 refs.]

[Storrs Agric. Experim. Station, Storrs, Connecticut.]

The authors have carried out a series of observations on the metabolism of strains of *Brucella,* using as their material 30 strains labelled as *Br. abortus,* 10 of bovine origin, 10 of porcine origin and 10 from human sources, and 11 strains labelled as *Br. melitensis.* The bacteria were grown

in 1 per cent. Fairchild's peptone, with or without the addition of 1 per cent. glucose. After incubation at 37° C. for 2, 6, 9 and 14 days, the broth cultures were analysed for free ammonia, amino and non-protein nitrogen, and for glucose. At the same time the changes in pH were followed by the usual colorimetric methods, and the rate of growth was observed by turbidity readings, checked by plate cultures and direct microscopic counts. In connexion with the latter, the rate of growth was studied both in air and in an atmosphere containing 10 per cent. CO_2.

The results obtained served to divide the strains examined into two well differentiated groups, the first containing the strains of *Br. abortus* derived from cattle, the second comprising the strains of *Br. abortus* derived from the pig, or from man, and the 10 strains of *Br. melitensis*, presumably of human origin.

The bovine strains grew more abundantly in the presence of 10 per cent. CO_2 than in air; the human and porcine strains grew better in air than in 10 per cent. CO_2.

In plain peptone all strains, irrespective of source, showed a steady decrease in the concentration of hydrogen ions. In the presence of 1 per cent. dextrose the bovine strains showed a similar increase in alkalinity; but the human and porcine strains all showed either an increase in hydrogen-ion concentration, or values approximately the same as the uninoculated controls. It would appear that strains of *Brucella* isolated from cattle are unable to utilize dextrose, while strains of *Brucella* isolated from man, or from the pig, can utilize this carbohydrate, whether, on other grounds, they have been classed as *Br. abortus* or *Br. melitensis*. This conclusion is supported by the quantitative determination of glucose at different periods. The porcine and human strains appeared to have utilized 4 to 18 per cent. of the dextrose; while the bovine strains caused no appreciable breakdown of this sugar.

The bovine strains showed a decrease in the amount of non-protein nitrogen during the course of the experiment. The human and porcine strains showed an initial decrease, during the first three days, followed by a slight increase.

As regards the amino-nitrogen, all strains, regardless of their source, showed progressively decreasing figures in peptone water, without dextrose; but the decrease was far more marked with the bovine than with the human or porcine strains. In the presence of dextrose the decrease in amino-nitrogen became negligible in the case of the human or porcine strains, but was still marked in the bovine cultures.

In the plain peptone medium all strains showed a large production of ammonia. In the presence of 1 per cent. glucose there was very little increase in the ammonia figures with the human and porcine strains, except with the *Br. melitensis* strains, where a slight increase was noted between the 9th and 14th days. The bovine strains, which were unable to utilize the glucose, still produced large amounts of free ammonia.

It would therefore appear that strains of *Brucella* of bovine origin differ from strains derived from man or the pig, including among the latter *Br. melitensis*, in that the former are unable to utilize dextrose and, in consequence, attack more vigorously the protein fractions and their derivatives.

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Griffith, F. **The Significance of Pneumococcal Types.** *J. of Hyg.*, 1928, v. 27, 113-59. [Path. Lab., Ministry of Health.]

The author records the results obtained in a considerable series of experiments, which form an important extension of his earlier investigations on antigenic variation in pneumococci.

The report is divided into several sections. In the first, the author records the isolation of several serological types of pneumococci from single specimens of sputum derived from cases of pneumonia. The procedure adopted was as follows.

A portion of the specimen under examination was inoculated intraperitoneally into a mouse. The pneumococci recovered from the mouse were typed in the usual way ; and a second portion of the sputum was then inoculated into another mouse, together with a specific antiserum corresponding to the type first isolated. This second mouse succumbed, in many cases, to infection with a pneumococcus of a different serological type. Where a specific antiserum was available a third inoculation was made, consisting of another portion of the sputum and the two antisera indicated by the earlier tests ; in this way a third serological type was often recovered. This process was repeated as far as the available reagents allowed. In this way a Type I and two different serological races of Group IV pneumococci were isolated from one specimen of sputum. Another yielded, successively, Type I, Type IIB and Type III, another Type II and Type III, and so on.

In the second section a strain is described which gave typical rough colonies on solid media, but agglutinated specifically with a particular Group IV antiserum, and maintained its virulence for mice throughout a long series of passage experiments. In the third section an account is given of a particular strain which agglutinated specifically with two antisera prepared against two different serological types.

The author then proceeds to a description and discussion of experiments designed to induce modifications in antigenic structure. After referring to the occurrence of the smooth-to-rough variation during growth in a specific antiserum, or after prolonged cultivation on solid media, he points out that the rough variants differ among themselves as regards their power to revert to the smooth form. Certain strains, which gave rough colonies and agglutinated non-specifically, retained the power, through many generations, of reverting to the virulent smooth type, when inoculated in large quantities

into mice. Such strains were found to possess a definite immunizing value, while rough strains which had lost all power to revert were devoid of this property. The rough strains employed in the later, and most significant experiments, had been shown to have lost the power of spontaneous reversion, in so far as the inoculation of 0·1 to 1 c.c. of culture into mice, repeated with single colonies isolated from many successive generations of a permanently rough strain, afforded no evidence of any tendency to reversion to the virulent smooth form. By a long series of passages from mouse to mouse it was sometimes possible to cause the reversion of a strain which, during subculture in the test-tube, had remained obstinately rough. This result was obtained far more frequently when very large inocula were given subcutaneously, such as the centrifuged deposit of 50 to 100 c.c. of broth culture.

Acting on the hypothesis that the effectiveness of large inocula of rough variants, in inducing reversion to the smooth form, might be due to the presence in the nidus of infection of small quantities of the smooth antigen, set free by the breakdown of large numbers of rough cocci each bearing a trace of this antigenic constituent, the author carried out a series of experiments in which large amounts of a culture of the smooth type, killed by heat, were inoculated with small amounts of the rough variant.

The sterility of the heat-killed cultures was in all cases tested by incubation, followed by plating, and by the injection of large amounts subcutaneously into mice; but, as the author himself states, the results of some of these experiments are so remarkable as to raise the question whether the ordinary tests of viability are sufficiently comprehensive.

These results may be summarized as follows. A rough variant may apparently be caused to revert to the smooth form by the subcutaneous inoculation into a mouse of a small dose of the rough culture, together with a large dose of the corresponding smooth form, killed by heat. In the case of the rough-to-smooth reversion of Type II strains, this result may be brought about when the smooth culture has been steamed for twenty minutes.

An apparent reversion of an R strain to its S form may occasionally be induced by the simultaneous injection of heat-killed S cultures of another serological type, especially when the latter have been heated for only a short period at 60° C.; thus an R Type II reverted to an S Type II, when inoculated into a mouse together with heated S Type I.

It would appear that the antigenic complex concerned in this induction of reversion [the author considers this to be not the specific carbohydrate itself, but that part of the specific protein structure of the virulent pneumococcus which enables it to manufacture the specific soluble carbohydrate] is more heat-resistant in the case of Type II and Group IV strains than in the case of Type I strains. The last fails to cause reversion after heating to 80° C.; both the former may do so after steaming at 100° C.

Finally, and most surprisingly, the inoculation into the subcutaneous

tissues of mice of an attenuated R strain derived from one type, together with a large dose of a virulent S culture of another type, heated at 60° C. for varying periods, has resulted in the appearance of a virulent S pneumococcus of the same type as the heated culture.

TABLE V.

Killed S pneumococci	Living R pneumococci	No. of mouse	Result	Type of culture obtained from mouse
Pn. 85, Group IV, steamed 20 min. Dose = deposit of 60 c.c. of broth culture	R 4, Type II. Dose = 0·25 c.c. of blood broth culture	405	Died 4 days	S colonies, Type II
		406	Killed 7 ,,	None
		407	,, 7 ,,	R colonies
		408	Died 4 ,,	S colonies, Type II
Pn. 160, Group IV, as above	R 4, Type II, as above	409	Killed 7 days	S colonies, Type II
		410	Died 4 ,,	,, ,,
		411	,, 4 ,,	,, ,,
		412	,, 3 ,,	,, ,,
II B, Group IV, as above..	R 4, Type II, as above	413	Died 3 days	S colonies, Type II
		414	,, 2 ,,	,, ,,
		415	,, 3 ,,	,, ,,
		416	Killed 7 ,,	R colonies
None	R 4, Type II. Doses = 0·75, 1·0, 1·0 c.c. of blood broth culture	462	Killed 19 days	None
		463	,, 19 ,,	,,
		464	,, 19 ,,	,,

TABLE VII.

Killed S pneumococci	Living R pneumococci	No. of mouse	Result	Type of culture obtained from mouse
Type I heated 2 hours at 60° C. Dose = deposit of 50 c.c. of broth culture	None	641	Killed 5 days	None
	,, ...	642	,, 6 ,,	,,
	,, ...	643	,, 6 ,,	,,
	,, ...	644	,, 6 ,,	,,
As above	R 4, Type II. Dose = 0·25 c.c. of blood broth culture	645	Died 3 days	S colonies, Type I
		646	Killed 5 ,,	R colonies from local lesion
		647	,, 6 ,,	,, ,,
		648	,, 6 ,,	,, ,,
As above	R 4, Type II, grown in the heated Type I deposit. Dose = 0·36 c.c.	649	Killed 5 days	R colonies from local lesion
		650	Died 4 ,,	S colonies, Type I
		651	Killed 6 ,,	None
		652	,, 6 ,,	One R colony

In this way the S form of Type I has appeared after the injection of living R Type II and heated S Type I, and S Type II has been derived from the simultaneous injection of living R Type I and heated S Type II. The clear mucinous colonies of S Type III have appeared after the injection of heated S Type III, together with living R Type II, or living R

Type I. Smooth strains of Type I have also been obtained when heated S Type I have been injected with living R Group IV.

Tables V and VII provide illustrative examples, including the control tests employed.

TABLE X.

Killed S pneumococci	Living R pneumococci	No. of mouse	Result	Type of culture obtained from mouse
Type I. Dose = deposit of 100 c.c. glucose broth culture heated 15 min. at 60° C.	None	978	Killed 13 days	None
	,, ...	979	,, 13 ,,	,,
	,, ...	980	,, 13 ,,	,,
As above	R 4, Type II. Dose = 0·25 c.c.	994	Died 2 days	S colonies, Types II and I
		995	,, 3 ,,	S colonies, Type I
Type I heated 25 min. at 60° C.	None	981	Killed 13 days	None
	,, ...	982	,, 13 ,,	,,
	,, ...	983	,, 13 ,,	,,
As above	R 4, Type II	996	Died 3 days	S colonies, Type I
		997	,, 2 ,,	,, Type II
Type I heated 40 min. at 60° C.	None	984	Killed 13 days	None
	,, ...	985	,, 13 ,,	,,
	,, ...	986	,, 13 ,,	,,
As above	R 4, Type II	998	Died 2 days	S colonies, Type II
		999	,, 2 ,,	,, Type I
Type I heated 50 min. at 60° C.	None	987	Killed 13 days	None
	,, ...	988	,, 13 ,,	,,
	,, ...	989	,, 13 ,,	,,
As above	R 4, Type II	1,000	Killed 12 days	None
		1	Died 3 ,, (Pn. in blood)	Culture overgrown

Table X shows well the increasing frequency with which the mixed inoculation is followed by the appearance of living pneumococci of the heated type, when the period of preliminary heating is shortened.

[The importance of these observations is obvious. The controls included would satisfy all ordinary standards; and, if one hesitates to accept the conclusions reached by the author, who regards the results as establishing the occurrence of a real transference of type, it is only because their implications are so startling and so far-reaching. The very definite influence of heating for longer periods, or at higher temperatures, in decreasing the frequency of the apparent change in type, does perhaps increase the probability that the true explanation will eventually be found to lie in an activation of some survivors of the heating process, under the influence of the living R forms inoculated with them.]

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Reviews.

An Introduction to Medical Protozoology. By Lieutenant-Colonel R. Knowles, I.M.S. Calcutta: Thacker, Spink and Co. (W. Thacker and Co., 2, Creed Lane, London, E.C.4). 1928. Pp. 887. Figs. 174. Coloured plates 15. Price 25 rupees.

This book is divided into three parts. The first consists of nineteen lectures covering very completely the range of medical protozoology; the second devotes seven chapters to laboratory methods; and the third is a very complete bibliography.

The object of the author has been to compile a textbook sufficiently comprehensive not only for the average student of tropical medicine, but also for the officer in charge of a laboratory requiring a book of reference on some of the more abstruse points of medical protozoology. As is justly remarked, there was until recently no textbook in which the subject was treated as a whole, and although Wenyon's work now fills this gap, Colonel Knowles regards this as being too voluminous and too expensive for the average student.

Much of the book under review is not original, being taken chiefly from books by Wenyon, Dobell, and also from Patton and Cragg. The matter, however, is well presented and arranged, and the book ought to go far towards fulfilling the author's object. Within the limits of the subject there is nothing of importance to man that is not treated in an authoritative manner, and parasites of lower animals related to those of man receive due consideration. The classification followed is that adopted by Wenyon, and is simple and logical. For purposes of completeness, lectures dealing with spirochætes, rickettsia bodies, chlamydozoa, rabies, etc., are included.

It would be wrong, however, to give the impression that the work is entirely a *réchauffé* and this is particularly true of the lecture on leishmaniasis. Of great interest is that section in which the transmission of kala-azar is discussed. A very complete summary of the investigation relating to the bed-bug as vector is given, this insect having been under suspicion for a period of about twenty years. Recent experiments seem to show that it plays no part, and the author is very definitely of this opinion. Other possible intermediate hosts are mentioned, but attention is focused chiefly on *Phlebotomus argentipes*, which is regarded as being undoubtedly the carrier, although positive proof is not forthcoming. This conclusion is founded on various circumstances. The identical distribution, on the body, of sandfly bites and oriental sores suggests that sandflies are the vectors of this allied condition. Napier in 1925 and 1926 made an exhaustive study of the conditions in localities where kala-azar was known to spread, in contrast to areas where kala-azar does not occur. These conditions, according to the author, clearly exclude the possibility of bed-bugs, fleas, lice, ticks, mosquitoes and *Triatoma rubrofasciata* being the transmitting agent;

on the other hand with one exception the conditions are compatible with *P. argentipes*. Sinton found that the distribution of *P. argentipes* in India appears to be identical with that of kala-azar. A study of the incidence of kala-azar showed that infections are most common in the months of July to October, and accordingly feeding experiments were carried out at that time with very successful results, as a large proportion of sandflies fed on kala-azar patients developed a flagellate infection. Subsequent work by the Kala-azar Commission under the Indian Research Fund Association showed that flagellate infection of the sandfly occurs, affecting at first chiefly the anterior portion of the midgut, and later spreads forward to the pharynx and buccal cavity, so that from the seventh or eighth day after feeding to the twelfth day or later the mouth parts are infected, and often heavily infected, whence the flagellates presumably reach man when the sandfly bites. The author considers two further proofs necessary to confirm transmission by *P. argentipes*. The first is to discover *P. argentipes* in the wild state infected by *L. donovani*, and this proof he claims to be furnished by the finding of *one* such sandfly by the members of the Commission (surely rather a "thin" case, cf. the earlier statement "the incidence of the disease in the infected areas is usually . . . . 1 in 50 of the total population.") The second proof is to transmit kala-azar from man to man, or to a susceptible experimental animal by the agency of *P. argentipes* under fully controlled experimental conditions. *This has never been done*, although many experiments, including experiments on the human being, have been carried out. It is suggested that some lowering of the resistance may be necessary before infection ensues. In his concluding remarks on the investigation of the bed-bug, Colonel Knowles quotes Wenyon as follows: "We may conclude therefore, that the bed-bug, though a suspected agent, still awaits the final verdict, and that unless more tangible and convincing evidence is forthcoming, the jury will most certainly disagree." Although the case for *P. argentipes* is infinitely stronger, this dictum would nevertheless seem to be still applicable. It should be noted that Culicoides, which was suggested by Mr. Bainbridge Fletcher as a possible vector, complies with the epidemiological conditions present. Some experiments with these insects by the Commission were however negative.

The chapters on technique are full and interesting, and give all the information necessary for those desirous of pursuing the subject. The method described for the use of the mirror and substage condenser of the microscope in examining unstained objects is optically wrong, and in practice gives inferior images to those obtained by true critical illumination.

There is one printer's error which is perhaps worthy of mention, as it is not self-evident and may give rise to confusion. In Plate X the letters F and H have been transposed, so that *T. vivax* figures as *T. congolense*, and vice versa.

The binding seems somewhat flimsy for a book that weighs approximately 4½ lbs., and it is doubtful if the volume would stand up to hard usage.

Nevertheless the work can be recommended as a good and full guide to all interested in this fascinating subject.

The Simple Goitres. By Lieutenant-Colonel R. McCarrison, I.M.S. Baillière, Tindall and Cox. 1928. Pp. xi + 106, 143 figs. Price 10s. 6d. net.

As the author remarks in the preface, the contents of this book formed the subject matter for a report to the International Conference on Goitre, held at Berne in August, 1927.

The problem of goitre is such a difficult one, and so much has been written on the subject, that this volume will be welcomed as giving, in a very concise and readable manner, the present views on the causation of simple or non-toxic goitres.

The author is recognized as an authority on the subject, so that these views are, in the main, the result of his experiments and observations made during the past quarter of a century, and published by him from time to time in various writings. There are few who would feel inclined to doubt the correctness of his conclusions, for his experiments seem to leave no possibility of error.

The result of his work in connexion with the school at Sanawar in the lower Himalayas has been often quoted, but its brilliance will be an excuse for repeating the story. He was satisfied that bacterial infection through the intestinal tract has an influence on causing chronic hypertrophic goitre, and when he investigated, in 1913, the conditions at this school, which had about 500 pupils, of whom 66 per cent above the age of 16 suffered from disfiguring goitres, he attributed the cause to a polluted water supply. His views must have been strongly expressed, for he induced the authorities to provide in 1914 a new piped supply. Within four years there were no cases.

Part II of the book consists of 143 figures which are as well chosen as they are excellently reproduced.

G. F. D.

The Clinical Examination of the Lungs. By E. M. Brockbank, M.D. (Vict.), F.R.C.P., and Albert Ramsbottom, M.D. (Vict.), F.R.C.P. Second Edition with illustrations. London: H. K. Lewis and Co., Ltd. 1928. Pp. viii + 112. Price 5s. net.

The appearance of the second edition of this little work shows that a want is being supplied.

The authors, both teachers of clinical medicine in the University of Manchester, appreciate the difficulty experienced by students in understanding the various physical signs of pulmonary disease, and this work gives the outlines of their teaching.

The book may be best described as the students' guide to the routine examination of the chest and the physical signs of disease of the lungs.

The subject is dealt with systematically and efficiently though briefly.

Correspondence.

ATYPICAL FEVERS, AT PRESENT REFERRED TO THE SAND-FLY GROUP.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—The discussion in Major Heatly-Spencer's article in the Journal for June, 1928, of "Atypical fevers, at present referred to the sand-fly group," opens up questions which have called for ventilation for some time past.

The first group, which he describes as embracing "a large number of abortive fevers of obscure origin and of little clinical importance," is common, at least, in the Punjab and the North-West Frontier Province with Baluchistan. Whilst agreeing with him that "a proportion of these are undoubtedly malaria," I must immediately disagree that they are "of little clinical importance"; no case of malaria should, in my opinion, be so regarded. The disease is so protean in its manifestations and so massive in its importance to the Army in this country, so easily becomes chronic if neglected in its early stages, and is, even now, so little really known, that the diverting of attention from these minor febrile manifestations, which may be, and frequently are, malarial in their origin, is fraught with danger both to the State and to the individual.

The second group of fevers of this class, to which Major Heatly-Spencer refers as the "intermediate type fevers," occurs also in the Punjab plain and constitutes there, as in Baluchistan, a problem of no little difficulty to the clinician, the pathologist and the hygienist. Some few of those which come within this general group are, I believe, modified enteric group cases; some others are influenzal; some are malarial, and others belong to the yet unclassified fevers of the tropics. It is possible, as Major Heatly-Spencer suggests, that we have to deal with a single type of unknown infection, and that spironemal; I am inclined to believe that the group is more complex in its ætiology than that. The investigation of this group of fevers is a very urgent demand on all medical officers.

Not a small part of the difficulty of this investigation is associated with the recent development of pathology in the Army in India. The pathology service is growing to such a degree that the one-time common diagnosis of "pyrexia of uncertain origin" has been made practically to disappear from statistical reports. The fact remains indisputable, however, that there are still in India many fevers whose ætiology is entirely obscure. The difficulty which surrounds the official use of the diagnosis P.U.O. makes it easier to record "sand-fly fever," "pharyngitis," "influenza," "dengue," "clinical malaria," even "myalgia" and "constipation," than to admit in

a series of official returns that the actual cause of admission to hospital has remained undiscovered after the patient's discharge. In many stations, therefore, especially where specialist medical officers (not that I wish to put forward any brief for such) are not actually stationed, these unknown fevers of the tropics are occurring and are passing unrecorded and, mostly, uninvestigated (beyond the elimination of the common known infections on which we, at present, concentrate attention), under statistical headings so diverse that neither the nature of the actual disease nor the possibility that the "sand-fly fever" of one station is the same as the "pharyngitis" of another, or the "myalgia" of a third, can easily be even suspected.

Major Heatly-Spencer has put before us the groundwork of a very necessary research, and also, and it is needed too, the reminder that the diagnosis of P.U.O. should not only remain in our records, but should also probably appear more frequently in our returns if these are to be plane, not distorting, mirrors of the facts of disease in the tropics.

I am, &c.,

Lahore District Headquarters,
Dalhousie, India.

R. A. MANSELL,
Major, R.A.M.C.

July 6, 1928.

BREEDING OF ANOPHELES.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—Extensive records, such as those of ex-Havildar Hira Lal of the Indian Hospital Corps, quoted by Major J. E. M. Boyd, in the Journal for May, 1928, are not available from all the malarious stations of the Lahore district. If such records are kept in the future I think they will show that continuous anopheline breeding commences very much earlier than Major Boyd would, apparently, have us believe. Intermittent breeding of several species occurs in favourable spots, I believe, throughout the year. Comparatively little is known yet of the habits of the Punjab anophelines; until there is more accurate information we must remain handicapped in our attacks on them.

This year active anti-malaria work did not start before the middle of April in the Lahore district; then, and even earlier in Sialkot, breeding was discovered (except in Lahore Cantonment and Multan) which has been going on steadily ever since. The dates here recorded are not, therefore, those of the absolute beginning of the breeding season. I do not consider them to be extraordinary, although they refer to one year only; they are in accord with my experience in other parts of north-west India.

I regret that these records are not quite as complete as they might be —such investigations have been a little new to some of our anti-malaria officers—but I hope that for future years they may be complete in all respects and of value to successive guiders of anti-anopheline warfare :—

Station			Larvæ found		Adults found
Ambala..	..	..	April (S.R.)	..	April (F.)
Ferozepore	..	..	April (R.) ..	..	May (R.)
Jullundur	..	..	April (R.F.S.)	..	—
Lahore Cantonment		..	May 10 (S.)	..	April (F.) May (C.S.P.)
Multan..	..	..	May 2 (R.S.)	..	May (C.) June (P.)
Sialkot..	..	..	April (S.) .. May (C.) ..	.. ..	—

I am, Sir, &c.,
R. A. MANSELL,
Major, R.A.M.C.

Headquarters, Lahore District,
Dalhousie,
July 30, 1928.

DYSENTERY IN INDIA.

TO THE EDITOR OF "THE JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—It has been brought to my notice that in the June number of the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, p. 411, there is a paragraph in my report on the dysentery in Poona, which might be read in the light of a reflection on the administration of Major J. C. A. Dowse, who was then in charge of the family hospital in Poona. The paragraph states that specimens frequently arrived dry in the laboratory and therefore could not be bacteriologically examined, and is very badly worded.

As is stated elsewhere in the report, Major Dowse from the day he arrived in Poona collaborated whole-heartedly in this investigation. He was good enough to write a very interesting account of his experiences on the clinical side of the dysentery cases among children in Poona, which was included verbatim in the original manuscript of the report. The Editor of the *Indian Journal of Medical Research*, however, considered that the original draft should be shortened and matter not dealing with the actual object of the report, viz., laboratory investigation, should be made the subject of special papers. The report was therefore recast, and the clinical side reluctantly omitted.

The suggestion of Major Dowse that dysentery cases among children fall into two definite classes was retained in the report, as it appeared to be an unusually important clinical observation, and with an important bearing on treatment. The offending paragraph referred to above was merely written to show that we had not the same absolute bacteriological proof of Major Dowse's views in the case of the small children, as in the case of older children and adults.

The laboratory is a considerable distance from the hospital, and with the hot weather prevailing at the time, plus the difficulty in collecting specimens from little children, and the lethargy of hospital sweepers on the road to the laboratory, fluid material on cloth naturally evaporated

rapidly. The cases in question were few, and responded quickly to treatment, and therefore were not made the subject of any particular investigation, otherwise no doubt special measures could have been taken to overcome the difficulties mentioned above.

The matter may appear too trivial to bring to notice, but it should be made plain that there can be no question of any reflection on an officer, who was taking part from the clinical side in what was really a co-ordinated research, and who had taken much trouble in writing up a valuable survey of his cases for the final report.

I am, Sir, &c.,

J. A. MANIFOLD,

Major, R.A.M.C.

Army Headquarters, India,
Medical Directorate, Simla,
August 22, 1928.

EDITORIAL NOTICES.

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Journal
of the
Royal Army Medical Corps.

Original Communications.

FURTHER OBSERVATIONS UPON VACCINATION AT WOOLWICH, 1926-27.

By M. D. MACKENZIE, M.D.,
Medical Officer, Ministry of Health.
AND
CAPTAIN E. H. W. ELKINGTON,
Royal Army Medical Corps.

SECTION I.

THESE observations are a continuation of the preliminary report published in the September number of the Journal, 1928, and cover the work carried out at Woolwich up to July, 1927. This section deals with the clinical characteristics of primary vaccination in the adult, and how far these are modified by movement of the vaccinated arm.

DESCRIPTION OF AN AVERAGE CASE OF PRIMARY VACCINATION.

Day of Vaccination.—There is little change in the appearance of the insertions during the first twenty-four hours.

First Day.—On the first day there is a faint reddening along the edges and ends of the insertions. There appears to be no change in the blood-count. Average size of areolæ 21·56 square millimetres. Average maximum temperature 98·8° F.

Second Day.—On the second day the area of redness has increased to about double that of the first day, there being a definite bright red areola round each insertion. The temperature previously normal now falls

slightly. There is no change in the red or total white blood-count, but with the fall of temperature there is a slight rise in the number of large and small lymphocytes, the increase being chiefly in the small. Areolæ 48·2 sq. mm. Temperature 98·3° F.

Third Day.—On the third day the areolæ have again increased in area to about twice that of the previous day. There is now usually a small red papule at the site of each insertion. The temperature remains subnormal and is slightly lower than on the previous day. There is a still further proportionate increase in the number of lymphocytes. Areolæ 84·3 sq. mm. Temperature 98·2° F.

Fourth Day.—On the fourth day the areolæ have still further increased in size. The papules have become vesicles. The temperature reaches its lowest point in its subnormal phase (about 98° F.). There is slight tenderness of the lymphatic glands in the axilla. There is still further increase in the lymphocytic count which now reaches its maximum (usually about 48 per cent of the total white count). The site of the vaccination is frequently "itchy." Areolæ 150·8 sq. mm. Vesicles 55·25 sq. mm. Temperature 98·1° F. Splenic enlargement 0·5 inch.

Fifth Day.—Again the areolæ show a regular increase; the vesicles continue to increase in size, but at a slower rate. The temperature begins to rise and is generally slightly above normal. With the rise of temperature there is a decrease in the lymphocytes with a corresponding relative polymorphonuclear increase. There is no marked leucocytosis. The axillary glands are tender and palpable. The patient complains of a feeling of malaise with some headache. Areolæ 277·3 sq. mm. Vesicles 89 sq. mm. Temperature 98·6° F. Splenic enlargement 0·75 inch.

Sixth Day.—The areolæ continue to increase in size. The vesicles steadily enlarge and are now sharply defined, with slightly raised edges and central umbilication. The vesicular contents are limpid fluid. The temperature continues to rise and is generally about 99° F. The blood-picture is practically normal. The constitutional symptoms become more marked and complaints of headache are common. The axillary glands are further enlarged and tender and the spleen is frequently palpable on deep inspiration. Areolæ 437·2 sq. mm. Vesicles 136. sq. mm. Temperature 99° F. Splenic enlargement 1 inch.

Seventh Day.—The steady increase in size of the areolæ continues with a corresponding increase in that of the vesicles, which are now filled with a slightly turbid fluid. The temperature continues to rise slowly, the blood shows no constant change from normal. The headache is often severe, and there is considerable enlargement and tenderness of the axillary glands. The spleen is often palpable. Areolæ 975·9 sq. mm. Vesicles 197 sq. mm. Temperature 99·2° F. Splenic enlargement 1·5 inches.

Eighth Day.—On the eighth day there is a marked increase in the size of the areolæ, which now generally coalesce. The vesicles maintain a steady increase in size, the fluid being now almost purulent in appearance.

There is a sharp rise of temperature (frequently to over 100° F.). The red and total white blood-counts remain normal, but with the rise of temperature there is a fall in lymphocytes. The constitutional symptoms are more marked. The arm is generally painful and the skin in the neighbourhood of the vesicles is swollen and indurated. The glands in the axilla are often very painful, and the spleen usually reaches its maximum enlargement on this day. Areolæ 5,318·5 sq. mm. Vesicles 251 sq. mm. Temperature 100·7° F. Splenic enlargement 1·15 inches.

Ninth Day.—The four areolæ have given place to one, which continues to increase in size. The vesicles, now definitely purulent, are still increasing in size and the centres are markedly depressed. The temperature reaches its maximum of about 101° F. The blood still shows a relative diminution in lymphocytes. There is no marked leucocytosis. Constitutional symptoms are at their height. The arm in appearance is much like that of the previous day, but the local conditions are more pronounced. The glands in the axilla are still painful and enlarged. The spleen is often palpable. Areola (now one) 11,092·2 sq. mm. Vesicles 335·3 sq. mm. Temperature 100·9° F. Splenic enlargement 1·25 inches.

Tenth Day.—The areolæ continue to increase. The vesicles begin to show signs of drying up in the centre. The temperature commences to fall and the patient feels much better. With the fall in temperature there is a relative increase in lymphocytes. The constitutional symptoms disappear, and there is little, if any, pain in the axillary glands, though these are usually enlarged. Areola 11,513·36 sq. mm. Vesicles 416·36 sq. mm. Temperature 100·47° F. Splenic enlargement 1·23 inches.

Eleventh Day.—The areola has now reached its maximum. The vesicles are definitely scabbing, but there is still purulent fluid at their circumference. There is a rapid fall of temperature. The lymphocyte count varies between forty per cent and forty-six per cent of the total white count. Although the local reaction is still marked, there are no constitutional symptoms and the patient feels well. The spleen cannot ordinarily be felt. Areola 18,720·14 sq. mm. Vesicles 480·00 sq. mm. Temperature 99·5° F. Splenic enlargement 1·25 inches.

Twelfth Day.—There is some fading of the areola. The vesicles are now at their maximum size of about 500 square millimetres, an almost constant aggregate area for four insertions, each seven millimetres long. The temperature continues to fall. Areola 13,577·33 sq. mm. Vesicles 511·38 sq. mm. Temperature 99·11° F. Splenic enlargement 1·00 inches.

Thirteenth Day.—The areola has now practically disappeared except in the immediate vicinity of the scabs, which are now complete and dark brown in colour. The temperature is normal.

After twenty to twenty-four days the scabs come off, leaving deep purple pitted scars, which fade in colour in the course of the following four to six months.

DIVERGENCIES FROM THE AVERAGE.

Local.—The average daily measurement of the areolæ in twenty-six patients shows that the area of the areolæ increases rapidly from the seventh day after vaccination, reaching its maximum on the eleventh day and falling rapidly afterwards. The vesicles were first observed late on the fourth day in 65 per cent of cases, and in the remaining 35 per cent on the fifth day. The average maximum size is reached on the twelfth day. Scab formation began as early as the eighth day in one case, and as late as the twelfth day in two cases, but in the majority scabbing began on the eleventh day. It is interesting to note that vesiculation first appeared at a time corresponding with the end of the initial fall of temperature, which for want of a better name may be termed the negative phase. The maximum temperature is reached two days before the area of the areola is at its maximum, and three days before the vesicles attain their greatest size.

General.—Certain general symptoms were complained of. Pain in the left axilla, with definite palpable enlargement of the axillary glands, was common to all; and in practically all cases there was headache and a general feeling of malaise. Two cases complained of sore throat, beginning on the sixth and tenth days respectively; there was slight injection of the pharynx and tonsils which lasted for two days. Of the general symptoms headache was the most severe; it was usually frontal, but occasionally occipital.

Temperature.—The four-hourly temperature charts of twenty-eight cases particularly examined give very similar pictures. The average maximum daily temperature shows that there is a definite fall from the second day, reaching its lowest point, 98·1° F., on the fourth day. Thence the temperature gradually rises to a maximum of 100·9° F. on the ninth day, the temperatures for the eighth and tenth days showing a drop of 0·2° F. and 0·4° F. respectively. The normal is reached on the thirteenth day. The highest temperature shown by any of the twenty-eight cases was 104·2° F. on the ninth day. There were only three whose temperatures never went as high as 100° F. In eighteen of the remaining twenty-five the maximum temperature was 102° F., or higher.

Splenic Enlargement.—During the examination, on the eighth day after vaccination, of a patient who complained of headache and abdominal discomfort, it was found that he had an enlarged and tender spleen. After this observation, made by Captain Elkington, R.A.M.C., who was in clinical charge of the cases, a daily examination of the abdomen throughout the course of vaccinia in thirty-one consecutive cases was made; in twenty-one of these cases there was definite temporary palpable enlargement of the spleen. In all cases in which the spleen was enlarged to the extent of one inch or more below the costal margin, there was tenderness on palpation. In one case, where the lower edge extended to two and a half inches below the costal margin, there was severe pain of a pleuritic character.

In two cases the enlargement was palpable as early as the fourth, in

two on the fifth, in three on the sixth, in three on the seventh, in six on the eighth, in three on the ninth, and in two on the tenth day after vaccination. In the two patients who showed enlargement on the fourth day, the spleen reached its maximum enlargement (about two and a half inches below the costal margin) on the eighth day and was still palpable on the thirteenth day. The longest time for which the spleen was palpable was ten days, and the shortest one day ; the average number of days on which the spleen could be felt in the twenty-one cases was 2·25 days, and the average maximum enlargement occurred on the eighth day after vaccination. Table XII summarises the relationship between the size of the areolæ and vesicles, the average daily maximum temperature, and the average splenic enlargement.

TABLE XII.

Day of observation	Average size of areolæ in 26 cases in sq. mm. (approx.)	Average size of vesicle in 26 cases in sq. mm.	Average maximum daily temperature Fahrenheit in 28 cases	Average splenic enlargement in 21 cases in inches (only approximate)
1st ..	21·65	—	98·32	—
2nd ..	48·23	—	98·35	—
3rd ..	84·80	—	98·21	—
4th ..	150·84	55·25	98·10	0·5
5th ..	277·38	89·00	98·67	0·75
6th ..	437·23	136·00	99·00	1·0
7th ..	975·92	197·4	99·27	1·5
8th ..	5,318·50	251·15	100·72	**1·75**
9th ..	11,092·28	335·38	**100·99**	1·25
10th ..	11,513·36	416·36	100·47	1·23
11th ..	**18,720·14**	480·00	99·5	1·25
12th ..	13,577·33	**511·38**	99·11	1·0
13th ..	11,870·42	506·34	98·57	0·9
14th ..	9,491·20	472·84	98·17	0·8

TABLE XIII.—The Average Daily Red and White Blood-Count in Seven Men on Successive Days after Vaccination made by Capt. Preston, R.A.M.C.

Day after vaccination	Red blood-count	White blood-count
1st ..	5,078,571	5,731
2nd ..	5,171,428	5,228
3rd ..	5,228,570	6,600
4th ..	5,471,428	6,428
5th ..	5,442,858	5,371
6th ..	5,214,285	6,371
7th ..	5,414,285	6,242
8th ..	5,028,571	5,785
9th ..	5,785,714	7,142
10th .	6,057,142	7,257
11th ..	5,514,285	6,285
12th ..	6,260,000	5,400
13th ..	5,320,000	6,120

Blood Changes.—Observations on the red and white blood-cells of seven cases have been made. On the day following vaccination a total red and

white blood-count was done in each case and repeated each day for twelve days. The observations on the differential count were made on a series of twelve cases. In both series the blood was taken at the same hour each day. A summary of the results of the red and white blood-counts is shown in Table XIII. There appears to be no marked change in the red count during the progress of vaccinia. No leucocytosis was observed.[1] In the differential count the ratio of the polymorphonuclear leucocytes to the lymphocytes appears to vary inversely with the temperature. With the fall of temperature which immediately follows vaccination, there is a rise in the lymphocyte count to about forty-eight per cent. The number of lymphocytes increased as the temperature fell, and conversely.

Rashes.—A local scarlatiniform rash caused by the strapping used to keep the dressings in position was a common feature seen early in the present year. When this cause had been recognized and the strapping was no longer used, this rash ceased to occur.

There are, however, other rashes associated with vaccinia. These appear generally about the ninth or tenth day after vaccination, whereas those due to the strapping appeared at an earlier date (fourth or fifth day).

The later rashes, which appear independently of the type of dressing employed, fall into one of three groups, viz., papulo-vesicular rashes (generalized vaccinia), true serum rashes, and erythematous rashes which may be localized or general and which may or may not be partially hæmorrhagic.

The pustular type of rash is the commonest and often closely resembles the acne pustules commonly found in young adults. The lesions may be distributed largely on the vaccinated arm or may be found only on the back, arms or face. The individual lesions ordinarily commence as papules, become vesicular and finally pustular, but a large number abort in the papular stage. This eruption is not associated necessarily with an unduly severe reaction on the arm or an abnormally high temperature.

A second group of rashes (serum) closely resemble those seen after the administration of antitoxin. The distribution is most intense on the vaccinated arm but may extend to a variable degree over the trunk. The lesions are generally bright red macules or are urticarial in appearance. The eruption is commonly accompanied by pruritus. Almost all the lesions seen in ordinary serum rashes may be observed in these cases.

The third and most interesting group of rashes appears about the tenth day. The distribution is generally most marked locally on the vaccinated area and in the corresponding axilla, but in two cases the distribution and appearance of the rash were indistinguishable from that of the prodromal rashes met with in cases of severe small-pox. In these cases the rash was limited to both axillæ, both arms as far as the wrists, the thighs as far as the knees, the buttocks, perineum, groins and lower part of the abdomen.

[1] This statement and Table XIII is based solely on the work of Captain Preston, R.A.M.C., who carried out the blood-counts.

The back, chest, face, legs and hands were free from rash. The lesions vary from a punctate erythema to a macular hæmorrhagic rash. Of the cases showing the typical distribution of prodromal rashes in small-pox, one was finely punctate and hæmorrhagic when first observed, and the other was morbilliform in type but bright scarlet in colour and later became hæmorrhagic. The occurrence of these rashes is not constantly associated with an undue severity of the local reaction on the arm, and the constitutional disturbance as shown by the temperature is variable.

Apart from the existence of a rash, subcuticular hæmorrhage may be frequently observed in the skin closely surrounding the vesicles in severe cases of vaccinia. This hæmorrhage appears either as a punctate lesion or as small purple areas. The condition appears to be associated only with severe reactions and is invariably strictly local in distribution.

Effect of Exercise on Recently Vaccinated Men.

A series of investigations was carried out in order to determine the effect of a moderate amount of exercise on men recently vaccinated for the first time.

The details of the method of vaccination are given in the Preliminary Report.

In each case one linear insertion about nine millimetres long was made for each insertion; four insertions were made. G.L.E. lymph was used. For the purposes of observation the men were divided into three groups:—

Group A.—Men vaccinated and at once admitted to hospital, where they were kept throughout the course of the vaccinia. The vaccinated arm was completely rested in a sling.

Group B.—Men treated in every respect similarly to Group A except that each man did two hours' arm exercise daily. The exercise consisted in work on a mariner's wheel and free arm and ladder exercises in the gymnasium.

Group C.—Men vaccinated and submitted to what was ostensibly whole-time work, including ground levelling, coal heaving, etc. The circumstances in which this was done were such as permitted of considerable remissions from time to time, and were therefore not strictly comparable with those which obtain in men who are normally pursuing those occupations.

In the case of Groups A and B the temperature was recorded every four hours for fourteen days after vaccination. The men in Group C were inspected on the tenth and fourteenth day after vaccination only.

In contrasting Group A and Group C, it is only possible to give the results of visual impressions with regard to the severity of the reaction. Arrangements were made, however, for the cases to be seen by a number of different observers, including some members of the Vaccination Committee. They were unanimously of opinion that vesicular develop-

ment was more rapid in men of Group C than in those of Group A. On the fourteenth day after vaccination the men in Group C showed complete scab formation, whereas in those in Group A the lesions were still partially vesicular in character. Also the arms of the men in Group C did not show more severe reactions than those in Group A, but rather the reverse.

These two conclusions are confirmed when Groups A and B are contrasted. Both groups were under close observation in hospital and daily measurements of the lesions were made.

In the men in Group B both the lowest and the highest temperatures were reached approximately one day earlier than in Group A.

The development of the vesicle was more rapid in Group B than in Group A.

With reference to the relative severity of reaction in the two groups, the reaction as indicated by the temperature is not more severe in cases doing exercises but rather the reverse. This is borne out by the fact that the average size of the vesicle is slightly larger in men resting than in men exercising.

SECTION II.

This section summarizes a number of observations made with regard to the relative severity of six-mark and two-mark vaccination and the effect of varying methods of inoculating the lymph.

As in the previous cases reported upon, the vaccinations were performed on men aged 18 to 20 years who had not been previously vaccinated. The technique followed was that described in detail in the Preliminary Report. The length of the insertions in each case was carefully marked with dividers on the arm before the incision was made, and in every case the total length of the incisions was the same in both six-mark and two-mark cases, viz., six marks each six millimetres long, or two marks each 18 millimetres long. After the operation the arms were kept at rest, the men being admitted to hospital for a period of fourteen days. Daily measurements of both areolæ and vesicles were taken, as described in the Preliminary Report, and the temperatures of the cases were recorded every four hours. All the insertions in all the cases were successful. The results described must be broadly interpreted.

Relative Severity of Six-Mark and Two-Mark Vaccination.

As noted above, the total lengths of the incisions in both six-mark and two-mark cases were the same. The average areola in both groups is strikingly similar in size until the seventh day. On and after the seventh day, until the twelfth day, the areola area for six-mark cases is definitely larger than that of the two-mark cases. On the twelfth and thirteenth days the total areola area in both groups is approximately the same.

In the case of the vesicular area in both groups, the date of first

appearance of the vesicle (with a single exception) in both groups is the same, viz., the fourth day after vaccination. Furthermore, at the time of their first appearance, and for some three or four days afterwards, the average total vesicular areas in both groups are closely similar in size. After the seventh day following vaccination, however, the six-mark cases show a definitely larger vesicular area than do the two-mark cases, a difference which remains patent until the thirteenth day. The average maximum areola and the average maximum vesicular area occur at approximately the same time in both groups, viz., six-mark cases average maximum areola after 9·5 days, two-mark cases 10 days, six-mark cases average maximum vesicular area after 11 days, two-mark cases 11 days.

With regard to the relative temperatures in the two groups, the average maximum daily four-hourly temperature reaches its highest point in both groups on the eighth day. For three days after vaccination the average temperature in both groups is the same. From the fourth day until the ninth day the two temperature curves closely follow one another, the temperature of the six-mark cases being, however, distinctly higher than that of the two-mark cases. After the ninth day following vaccination the average temperature curves of the two groups are closely similar. The highest temperature recorded was in a six-mark case, viz., 104·6° F.

The observations detailed above suggest that the number of insertions does not affect the date of appearance of the vesicle, the date of the average maximum areola, the date of the average maximum vesicular area, or the date of the average maximum temperature. In other words, vaccinia does not appear to be accelerated or retarded by the number of insertions made.

On the other hand, the same original length of incision with approximately the same dose of lymph gives rise to varying areola and vesicular area, and temperature according to whether it is divided into six or two lengths. In the case of the six insertions the areola and vesicles were larger and the temperature was higher than was the case in the two-mark cases. It follows as a corollary, that in order to get the same vesicular area in the two cases if two insertions only are made, these must be of a greater total length than is the case if six insertions be made.

The Relative Severity in Reaction of two Methods of Inoculation of Lymph.

A number of men not previously vaccinated were divided into two groups. Both groups were kept at rest in hospital and were treated precisely similarly, except in regard to the method by which the lymph was introduced. The technique followed was that described in the Preliminary Report. All the cases were vaccinated with four insertions with the same total length of incision. All the insertions in all the cases were successful. In one group (Type I cases) the whole tube of lymph was energetically rubbed into the insertions, whilst in the second group (Type II cases) the

incisions were only touched lightly with a lancet bearing a very small quantity of lymph, as small a quantity as possible of lymph being introduced, but care being taken to infect the whole length of each insertion.

Contrasting in the first instance the areolæ of the two groups on the day after vaccination, the average areola area in both groups is the same. Broadly speaking, the two curves are similar until the ninth day. From the ninth day to the eleventh day, however, the Type I cases show a distinctly larger average areola than do the Type II cases. On and after the eleventh day, allowing for the unavoidable inaccuracies in measurement of an area of inflammation, the areola areas in the two groups are similar.

In the case of the vesicular area in both groups, in three out of the eleven Type II cases vesiculation did not occur until the fifth day and, moreover, in the remaining cases the average vesicular area on the fourth day was only twenty-six square millimetres in the Type II cases, as compared with eighty square millimetres in the Type I cases, whereas the average areola area on the day following vaccination, and on the subsequent days until the ninth, is closely similar in both groups.

Once vesiculation is established the rate of development is approximately the same in both groups, the average maximum size being reached on the eleventh, twelfth, and thirteenth days in both groups. The average maximum areola and the average maximum vesicular area occur at almost the same time in the two groups, viz., Type I cases, average maximum areola area 9·7 days; Type II cases, 10·2 days; Type I cases average maximum vesicular area 12·1 days; Type II cases 11·9 days.

With regard to the relative temperatures in the two groups, the average maximum daily four-hourly temperature reaches its highest point in both groups on the eighth day. During a period of four days after vaccination the average temperature in both groups is similar. The temperature curve of the Type I cases appears to rise more rapidly than that of the Type II cases, but both reach the same maximum on the same day. The temperature curve of the Type I cases falls rather more rapidly than that of the Type II cases. Broadly speaking, however, and allowing for the small numbers of cases available for observation, the two temperature curves are very similar.

The observations detailed above suggest that apart from the earlier appearance of the vesicles, the dates of average maximum areola area, of average maximum vesicular area, and of average maximum temperature, are closely similar in both groups. It would appear, therefore, that vaccinia is not accelerated or retarded in either group.

On the other hand, as far as deductions can be made from the small numbers available, the effect of energetically rubbing the lymph into the incision appears to affect the local reaction rather than the general reaction. The temperature, which constitutes our only practical method of comparing

the severity of the general reactions, reaches a similar average maximum in both groups on the same day and, as has been noted above, the temperature curve in both groups is closely similar throughout the course of the illness. It is, however, when the areola and vesicular areas are compared that a marked difference is noticeable in the two groups. The early development of vaccinia is similar in both groups, but eventually the Type I cases evince a markedly more severe reaction than the Type II cases, as shown by the definitely greater average areola and vesicular area. It follows that, given the same length of original incision, larger vesicles will be formed if the lymph is well rubbed into the incision at the time of vaccination than will be the case if the lymph is only lightly applied. The larger vesicles, however, in the cases under observation, do not seem to be accompanied by any greater general reaction, as evidenced by the four-hourly temperature.

SECTION III.

This section outlines the practical applications of the investigations carried out at Woolwich.

(1) *Single-Line Scarifications and Severity of Reaction.*—The effect of using single-line scarifications, as contrasted with cross-hatched scarifications, is greatly to reduce the severity of the local reaction to vaccination.

(2) *Single-Line Scarifications and the Interpretation of the Result of Vaccination.*—Single-line scarifications facilitate the interpretation of the result of re-vaccinations. If multiple scarifications be used, the exuded serum and necrotic, damaged tissue may be recorded as a "take" in a case which is in point of fact a failure.

(3) *Single-Line Scarifications and the Immunity Reaction.*—Single-line scarifications only can be used for accurately determining the end-point of the immunity reaction.

(4) *Exercise and Vaccination.*—Three independent series of experiments appear to show that there are no fewer severe arms if men are excused duty after vaccination, but rather that the reverse is the case. It is to be noted, however, that there was no opportunity of testing the effect of very hard and continued manual labour (e.g., miners or stokers in civil life), and the only definite conclusion that can be drawn is that a certain amount of exercise after vaccination is definitely beneficial, and that this amount is not exceeded in the ordinary training of a recruit in the Royal Artillery.

(5) *Scar Area and Immunity.*—It is shown that the amount of immunity remaining at 18 years of age after infant vaccination varies with the size of the scar area, but not with the number of insertions, except in so far as these increase the total scar area. The Ministry of Health require that a total area of at least half a square inch should be obtained by public vaccinators, and it will be seen from the figures published in the

Annual Report of the Chief Medical Officer of the Ministry of Health, for 1926 (p. 39), that this area appears to give complete immunity to small-pox to an infant for a period of at least ten years. In order, therefore, to protect a soldier during his time service, it is probably necessary to obtain at least half a square inch of total scar area in a case of primary vaccination. This area of scar tissue results if four single-line insertions be made, each incision being about three-eighths of an inch (six to seven millimetres) in length, or two single-line insertions, each being about three-quarters of an inch (sixteen to eighteen millimetres) in length.

(6) *Number of Insertions.*—It is shown that the number of insertions made in infancy does not, *per se*, apart from the area of scar produced, affect the amount of residual immunity in men of 18 years of age. Moreover, it is observed that with two-mark vaccination a less severe reaction is produced for the same total length of incision than is the case if six insertions are made. The most satisfactory results would therefore appear to be obtained by two single-line insertions of sufficient length to give half a square inch of total scar area.

(7) *Value of the Immune Reaction.*—The value of the immune reaction is confirmed. Under the ordinary conditions of routine vaccination in the Army, when inspection is carried out on the seventh day after vaccination, it is impossible to observe the immune reaction. Instances arise, however, both in civilian and military populations, in which the saving of time resulting from the early interpretation of the result provided by the immune reaction may be of great value, e.g., in the protection of staff drafted into a small-pox hospital in emergency, or in connection with emigration, or the landing of individuals abroad in countries where a certificate of recent successful vaccination or immunity to small-pox is a condition of landing, etc.

(8) *Inoculation of the Lymph.*—Care must be taken to inoculate the whole length of each insertion with lymph, but there is no advantage to be gained by energetically rubbing the lymph into the insertion. The latter method results in an unnecessarily severe local reaction.

(9) *Date of Inspection of Primary Vaccinations.*—It will be seen that in cases of primary vaccination the temperature reaches its maximum on the ninth day, the areola on the eleventh day, and the vesicles on the twelfth day after vaccination. Inspection of the arm on the seventh day after vaccination gives, therefore, no idea of the severity of the reaction, which does not reach its maximum until two days afterwards in the case of the constitutional disturbance, or four days afterwards in the case of the local reaction. Primary vaccinations should therefore be inspected on or about the tenth day after vaccination.

(10) *Relation of Constitutional Disturbance to Local Reaction.*—The observations show that vaccination is accompanied by severe constitutional disturbance, manifested by high temperature (average maximum 101° F., individual maximum 104·2° F.), enlargement of the spleen and lymphatic

glands, changes in the blood-count, headache, malaise, and sometimes the development of a generalized rash. It is further shown that the constitutional symptoms and signs reach their maximum some two or three days before the local reaction does so. Observations of the individual cases demonstrate that the amount of the local reaction is no criterion of the severity of the constitutional disturbance. From a practical point of view it is, therefore, very important not to judge the amount of constitutional disturbance by the appearance of the arm. A patient may have a temperature of 103° F., and a spleen enlarged two fingers' breadth below the costal margin, with no abnormal local reaction. In such a case, unless care in examination be taken, a patient who is really ill may be regarded as a malingerer.

(11) *Rashes.*—These may be produced by strapping, and it is therefore important only to use strapping which is known to be free from the resin causing the rash, or failing this to employ bandages or tapes. In connexion with the occurrence of rashes, it is important to remember that post-vaccinal rashes may be mistaken for the prodomal rashes of small-pox or for the rash of scarlet fever.

MILITARY HYGIENE AND PATHOLOGY IN INDIA.

By LIEUTENANT-COLONEL J. MACKENZIE. V.H.S.
Royal Army Medical Corps.

II.—MALARIA.

(*Continued from p.* 255.)

THROUGHOUT the civilizations of the past the "captain of the armies of disease" has taken incalculable toll of human life and treasure, destroyed armies, depopulated cities, arrested the development of vast territories, and brought empires to decay.

In hieroglyph and rune, incantation and hymn, in fable and poem and story, the chronicle of his felonious career runs through the ages.

To-day this blood-thirsty Moloch, gloating over his multitudinous prey and defying all attempts at subjugation, sits firmly astride the globe; and even the emissaries of the parliament of the world, sent out to plan his overthrow, recoil from his malignant breath and counsel first the monster's appeasement with copious draughts of the milk of bonification.

The number of his victims is beyond computation.

In India alone 100,000,000 are attacked every year, and the annual toll of the dead is from one and a half to two millions.

Can plague, or cholera, or war, do this?

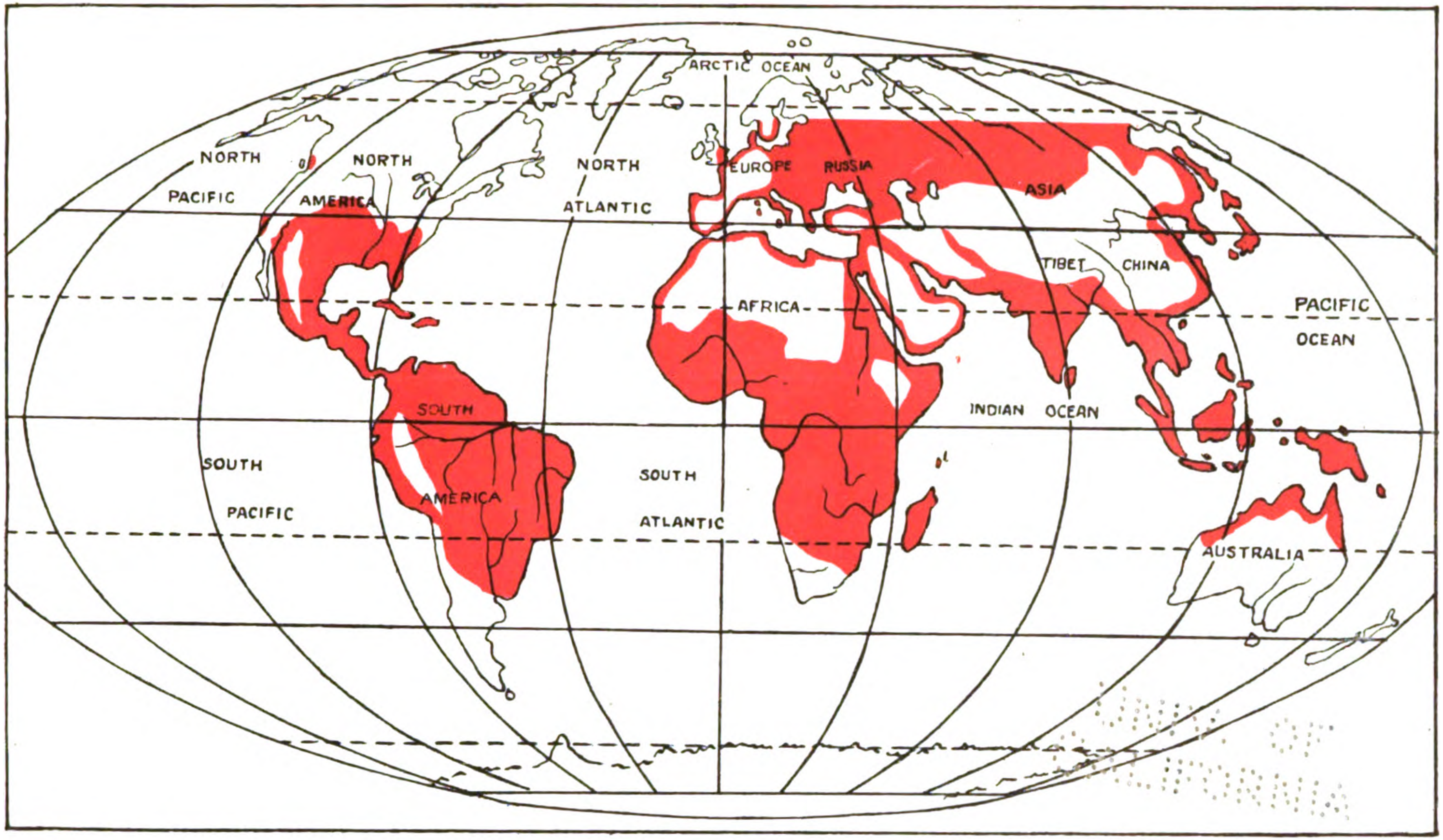
Malaria dominates the health statistics of the British Army "at home and abroad." From year to year it heads the list of the principal causes of sickness, leading by thousands against any other disease.

The great bulk of this malaria is due to India.

To quote the Royal Commission's Report (1859-1862):—

"At all the stations of India, from the Himalayas to Cape Comorin, the presence of malaria can be traced by its influence on health. It is the chief cause of periodic fevers and certain forms of marasmus and spleen disease among the native population. . . . It is the product of heat, moisture and vegetable decomposition. It appears to be absorbed largely and retained by the soil, and is given off, on the first fall of rain or on turning up the ground, in sufficient intensity to produce disease in susceptible persons exposed to it. . . . This malaria is universally believed by the natives of India to be conveyed in the drinking water. . . . A mist is seen rolling up the valley with the breeze, and the malaria is taken up in this way. . . . The importance of these and similar facts was not recognized when stations were first occupied, and many of them were placed in deadly localities, which had in the end to be deserted after great cost had been incurred in their formation. . . . We must assume the three peculiarities we have enumerated—heat, moisture and malaria—as constantly present, and everywhere influencing the sanitary condition of the country."

THE MOLOCH'S KINGDOM.



MALARIA ASTRIDE THE WORLD.

The Commission placed malaria in the forefront of the causes of sickness in the British Army in India.

After 1837, for a period of over twenty years, "fevers" were annually responsible for :—

776	admissions	and	14·4	deaths	per	1,000	of strength	in	Bengal
293	,,	,,	3·8	,,	,,	,,	,,	,,	Madras
767	,,	,,	12·9	,,	,,	,,	,,	,,	Bombay

In 1860, the admissions and deaths for "fevers" in a strength of 64,455 were :—

	Admissions	
	Actuals	Per 1,000
Febris intermittens	23,631 ..	367
,, remittens	6,016 ..	93
,, continua	14,407 ..	223
	44,054 ..	683

Even if half the cases of "febris continua" are excluded as being of doubtful nature, we still have nearly 40,000 admissions for malaria, or one-third of the total admissions for the year (123,517).

Year after year similar figures were recorded with monotonous reiteration, but without any remarks as to preventive measures. Fever was due to "climate," and therefore inevitable.

The plasmodium was not yet discovered, the mosquito not yet brought to book. The whole subject was enshrouded in a fog so dense that even the best informed could only dimly discern its form and outline.

Treatises on malaria, if they ignore the Egyptian AAT, usually begin with Hippocrates, who stated that the spleens of those who drank the water of marshes became enlarged and hard, while others affirmed that it generated fevers.

In more modern times it was held that the air of marshes was the sole cause of intermittent fevers. The marshy-smelling water of the Landes in S.W. France was believed to produce "intermittents and visceral engorgements."

Parkes, in 1864, wrote: "The following soils have been known to cause the evolution of the agent, causing periodical fevers in the malarious zone: (1) Marshes; (2) large collections of vegetable matter in the soils of valleys, ravines, etc.; (3) sandy plains; (4) certain hard rocks and disintegrated rocks are said to be malarious; (5) iron salts."

And again: "The external cause of malaria is presumed to be putrescent or, at any rate, decomposing vegetable matter, which is carried into the body by the medium of water or of air. . . . Houses can be so built as not to present openings towards the side of the malarious currents."

He found among the inhabitants of the highly malarious plains of Troy during the Crimean War a belief that those who drank marsh water had fever at all times of the year, while those who drank pure water only got "ague" during the late summer and autumn months. "At Sheerness the

use of ditch water, which is highly impure with vegetable debris, has been also, *with great probability*, considered to be one of the chief causes." . . . "Is it not possible that the great decline of agues in England is partly due to a purer drinking-water being now used? In Hungary . . . . to avoid the injurious effects of the marsh water, it is customary to mix brandy with it, a custom which favours hypertrophies of the inner organs."

Many observers in India "proved" that malaria was caused by drinking tank water.

A long and closely reasoned article in the Army Medical Department Report for 1864 has the following preamble :—

"In 1861 I drew attention to the connexion of the successive outbreaks of fever in various parts of the world with a series of waves proceeding, at intervals of a few years, from the southern to the northern hemisphere. From the extent these embraced in longitude, and the length and regularity of their course, they evidently depended on some general law, which, as their progress seemed uninfluenced by atmospheric currents, was most probably terrestrial. As the waves reached a higher latitude in Europe than in North America at the same time, the position of the magnetic pole, close to the north of the latter, suggested the connexion with magnetism. . . . . Dr. Angus Smith, of Manchester, has stated that ground giving out malaria is alkaline. If this be always so, from the well-known influence of electric currents in determining the position of acids and alkalies, after decomposing the neutral compounds which these previously formed, some clue may be found to unravel this hitherto complicated and obscure subject."

In the Report for 1866 Parkes discussed "The fungoid origin of malarious disease." "The connexion of malarious disease with fungi is as yet uncertain. Attention has been directed to a possible connexion with plant life. Dr. Massy has published a very interesting account of the prevalence of fungi at Jaffna. He shows the great prevalence of fungi, their passage into the drinking-water, and apparently their presence in the excretions of persons suffering from ague. They were found in the urine drawn off with the catheter, and in one case partly formed a urinary calculus. Dr. Massy observed increased prevalence of malarial disease to be coincident with the increased development of fungi; and his observations suggest an explanation of the well-known power trees exert in stopping the transit of malarious particles. He found the leaves of such trees greatly affected with black rust."

An Appendix in the Report for that year has the following: "Malarious fever might well be called a disease of the sympathetic, for its chief symptoms proceed from injury to the organic system of nerves, upon which the malarious poison exerts a change . . . . the regular accession of the attack at certain hours is probably dependent on the relatively increased power of the poison during those periods of nervous depression which correspond with the declination of the barometer and electric tension."

The remedies advocated by the writer included quinine, arsenic, nux vomica, stimulants (especially wine), venesection, alkalies, purgatives, cold affusion, emetics and iron, iodine locally applied to reduce the swollen spleen, and "change to a purer atmosphere."

In 1868 the total admissions to hospital were 70,232, of which over 17,000, or about a fourth, were for malaria. Only 100 men were invalided home for this disease, but 367 were invalided for "atrophia"; one unfortunate trio were classified quite simply as "worn out, 3."

At that time the new theory of the microbic origin of disease was coming under discussion. The agents or "contagia" of certain diseases were suspected of being solid particles and not vapours. "In the water of the marshes of certain places there was one plant which attracted attention by its abundance, and was always in proportion to the putrefaction of the infusoria. This was a little plant, a microphyte granule, belonging to the algæ, of a constant and special form. It was always mixed with a considerable quantity of little spores, $\frac{1}{1000}$ millimetre in diameter, greenish, yellow and transparent, also with sporangia or vesicles containing the spores of $\frac{2}{100}$ to $\frac{8}{100}$ millimetre in diameter. It floated on the surface, and when young was like drops of oil. . . . These spores and sporangia could diffuse in the air. . . . Balestra thinks these spores are the cause of marsh fever, or contain the poison. The algæ is not produced in day time, but will arise after slight rains, and even in mists and heavy dew. Hence the author explains the development of fever at Rome in August and September."

In 1871 roughly 25,000 cases of malaria were admitted to hospital, or between a third and a fourth of the total admissions.

In 1880, Laveran, a French army medical officer, described the parasite of malaria as he found it in the red corpuscles of the blood. His discovery was received with scepticism, and was not accepted until some years later.

Oldham devoted a whole book to his theory that malarial fevers were entirely due to "chill," and that no specific poison was involved.

In the Report for 1882, malaria was still ascribed to bad air. "The broken ground in the vicinity of the principal nullahs must also, particularly after a heavy rainfall, exhale malaria in the superficial drains which permeate the barracks in every direction."

In 1887, ". . . . the rain all falling within two months, average sixty inches, the growth of vegetation is very rapid. . . . When rains cease, and hot sunny days take their place, in a few weeks the pools of water dry up, and moisture and rotting vegetation alone remain, malaria is set free and paroxysmal fevers begin."

In 1892 malaria was very prevalent in Lahore and Peshawar districts; in the latter it accounted for almost two-thirds of the total admissions. The highest death-rate of the year was 36·79 per 1,000 in Peshawar district, "more than one-half the number of deaths having resulted from malarial fevers." "At Nowshera and Peshawar malarial fevers caused

quite five-eighths, and at Ferozepore more than half the number of the total admissions."

In 1896 malaria accounted for almost one-fifth of the total number of admissions in British troops "at home and abroad."

In the last decade of the nineteenth century the transmission of the plasmodium from man to man by certain species of mosquitoes, suggested by Manson, Laveran and others, and worked out chiefly by Major (now Sir Ronald) Ross, became definitely established, and the whole subject was placed on a scientific basis.

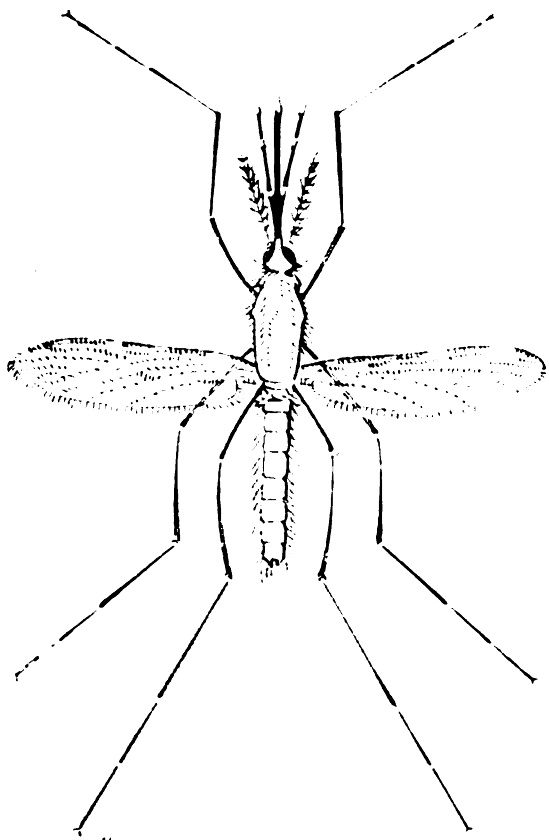


FIG. 2.—The Arch-enemy of the British Troops in India—*Anopheles culicifacies* (female).

The following examples of malaria incidence are taken from the Report for 1898:—

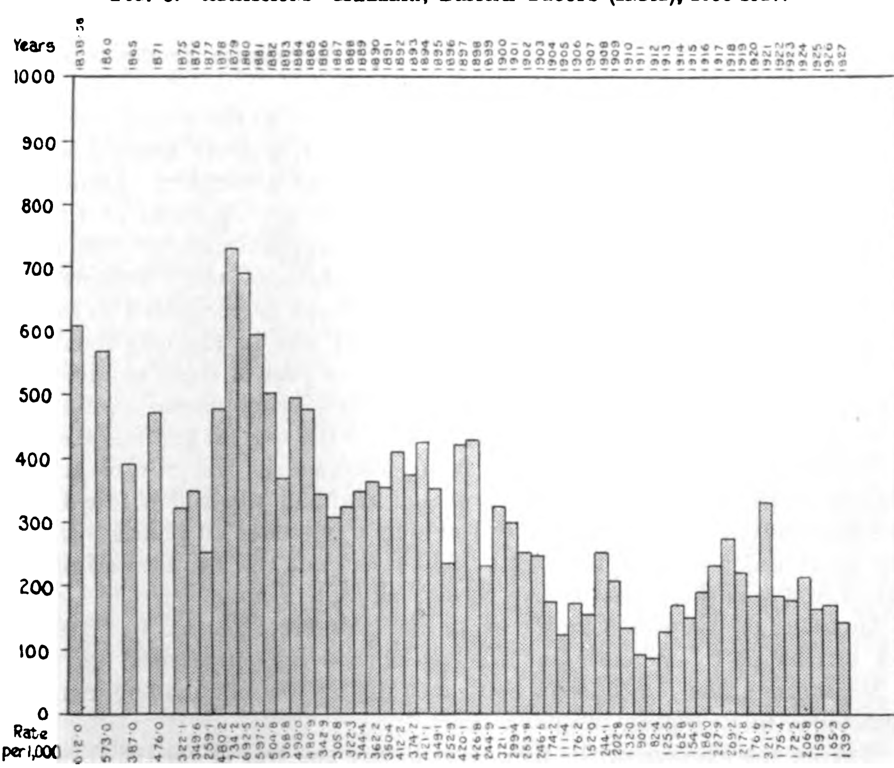
	Malaria admissions per 1,000
Fort Lahore	2,000
Barrackpore	1,862
Delhi	1,518
Peshawar	1,214

In 1900 the P.M.O. Bengal, in his Annual Report, remarked, "The provision of mosquito nets with a view to the prevention of malarial fever has been recommended, and is under consideration."

The new knowledge of malarial ætiology was now to bear fruit. Yet, even when the fog was clearing away, and the parasite and vector of malaria were known, facilities for the differential diagnosis of fever cases in many military hospitals remained primitive until quite recent times.

In 1903 the admission rate for malaria fell below 200 per 1,000, and during the last quarter of a century has only twice exceeded that figure.

FIG. 3.—ADMISSIONS—MALARIA, BRITISH TROOPS (INDIA), 1838-1927.



In 1910 the Annual Report records a fall of some 5,000 in the malaria admissions, to 132 per 1,000. "It cannot be affirmed that this lessened malaria incidence is due to any remarkable action on the part either of the State or of the medical services. It must be confessed that, in spite of the reduced amount of malaria in 1910, the continued prevalence of paludal fevers in Indian garrisons is now the greatest problem requiring solution . . . . There is little doubt we need much more knowledge than we now possess. We need to know, not only the degree of infectedness

of the human population, but also to what extent the mosquito population is infected. Thus, we need exact returns as to the percentage of mosquitoes in whom zygotes are present in the stomach, and the percentage of mosquitoes which contain sporozoits in their salivary glands . . . . the seasonal variation of infectivity among mosquitoes; and also whether it may not be that other insects besides mosquitoes carry malaria infection . . . . The hope is held that in the course of time we shall be able to explain some of the anomalies which are now so perplexing." Also, "there has been no abatement of active antimalarial measures in all our garrisons by means of mosquito brigades. . . . With the same object, the use of mosquito nets by troops is gaining ground, and many units have supplied themselves, at their own expense, with these valuable protectives."

We may safely attribute a part of the fall in malaria incidence at this time to the use of mosquito nets.

In 1911 the admissions for malaria fell by 3,045 to the record low figure of 6,527 or 90 per 1,000. In those days, however, a great many hospitals were still without microscopes, and diagnosis was uncertain. Admissions for pyrexia of uncertain origin were 1,914. If a proportion of these is attributed to malaria, we arrive at a figure of approximately 8,000 actual admissions for malaria; if those treated in barracks and "detained" in hospital are also taken into account it may perhaps be permitted to assume that the real figure for malaria attacks in 1911 was in the neighbourhood of 10,000, or even 12,000 or more, and that in "a year of small and irregular rainfall." Malaria case sheets were in use and prophylactic quinine was in favour; mosquito brigades tenaciously plied the oil-can and the spade.

In 1912 there was a slow but steady increase in the use of nets by soldiers in barracks, many being provided regimentally and a few by the men themselves; the State provided nets in a few selected places. In that year there was a further decrease of 680 cases, and the hospital admission rate of 82·4 was the lowest ever recorded before or since.

In 1913 malaria admissions rose to 8,880 or 125·5 per 1,000. The rise was attributed to epidemic malaria, which occurred in several garrisons in Northern India. "Malaria continues to be the dominating cause of inefficiency in European troops in India."

Taking the average of the five years before the war (1909-1913), we get an annual admission rate of 106·5 per 1,000. At that time, however, outdoor treatment of malaria was in fashion; large numbers were merely "detained" in hospital for a few days, and then completed their treatment in barracks. I think those in a position to know the facts will agree that 200 per 1,000 would not be an over-estimate of the true incidence of malaria in those years.

Up to the end of 1921 statistics were affected by the abnormal conditions following the war. 1922 and the years following may be taken as "normal" years.

Year		Admissions to hospital		
		Malaria		All causes
1922	.. ..	10,552	..	37,836
1923	.. ..	10,875	..	37,595
1924	.. ..	12,120	..	38,569
3 years' total	..	33,547	..	114,000

A study of the statistics of the last hundred years leads irresistibly to the conclusion that, allowing for certain factors, the outline of the medical history of the British Army in India is, in the main, the curve of malaria incidence. Cholera has come and gone, enteric fevers have risen and declined; malaria remains—the great incubus, the maze from which there seems, or seemed, to be no outlet.

Of recent years it may be said that roughly thirty per cent of all admissions to hospital are for malaria.

In 1923 antimalarial measures were defined as: (*a*) Efforts directed against the source of the disease in the human carrier (quinine treatment). (*b*) Protection against mosquitoes: (1) mosquito nets, (2) punkhas, (3) repellents, (4) protection of men between sunset and lights out. (*c*) Anti-mosquito work (drainage, oiling, etc.).

In 1924 it was decided to review the whole position *de novo*.

The determining factor in most districts was known to be the *quantity and duration of the monsoon rainfall* as was clearly shown by the station, district and all-India charts. Amongst other factors are altitude, temperature, level of the subsoil water, impermeability of the soil, existence of nullahs, marshes and unused wells, badly-controlled irrigation, innumerable pools in grass lands, pH content of breeding waters, larval food-supply, insufficient drainage, want of control over areas bordering on cantonments, dimly lighted barracks, inadequate protection of individuals, and imperfect education as to the cause of malaria and the means of prevention.

Detailed information as to these factors was available for a few stations, but there were no tabulated data dealing with the whole of India. Preventive measures were locally organized and comparatively ineffective. Even at Army Headquarters questions regarding malaria were dealt with by the Quartermaster-General's Branch under the heading "Conservancy—drainage."

Intensive propaganda, in which the Rockefeller malaria film (obtained from America) played an important part, resulted in an astonishing degree of enlightenment. Malaria was divorced from its ill-assorted match with conservancy and accorded a more dignified place under medical control.

In August, 1924, central organization of antimalarial measures came into force.

A form of monthly report was drawn up and issued to all the larger malarious stations, calling for the following data:—

(A) Permanent factors.

(1) Altitude.

(2) Period of annual rainfall and amount.
(3) Season of malarial infection.
(4) Species of anopheline vectors.
(5) Permanent breeding-places of vectors.
(6) Depth of the subsoil water.
(7) Strata of the soil to a depth of twenty-five feet below ground level.

(B) During the month.

(8) Range of temperature. Maximum: highest and lowest. Minimum: highest and lowest.
(9) Rainfall (in inches).
(10) Range of humidity.
(11) Temporary breeding places of vectors.
(12) Barracks, etc., in which vectors have been found.
(13) Hospital admissions for malaria :—

	Fresh cases				Relapses	
	Infected in station		Infected elsewhere		British	Indian
	British	Indian	British	Indian		
B.T.						
M.T.						
Quartan ..						
Clinical ..						
Total ..						

(14) Meetings of the antimalaria committee (dates and summary of proceedings).
(15) Antimalaria measures carried out during the month, with details of expenditure.

The information thus obtained was entered in an all-India malaria register. The mysteries of Lahore Cantonment (Mian Mir), Amritsar, Peshawar, etc., were deeply probed.

When, after a few months, the permanent factors had been accurately defined, these were omitted from subsequent reports,

Steps were taken to obtain funds, and early in 1925 one lakh of rupees (£7,000) was sanctioned for this purpose.

Station schemes had meanwhile been called for; these were now examined and co-ordinated, and on them the lakh of rupees was distributed. The schemes submitted amounted to several lakhs, and had to be severely pruned and pared to bring them within the lakh available. Cantonment Boards also contributed to some extent.

At the same time the question was considered of removing troops

from highly malarious stations to the hills during August, September and October ("cold storage").

Nearly eighty years previously, in 1846, Major (afterwards General Sir Henry) Lawrence, wrote: "Considerations of finance, as well as humanity, might open the eyes of those in authority to the advantage of locating their European troops in the hill-stations with such facilities for communication as might enable the men to be brought down speedily on any emergency. . . . The first outlay would be considerable but in ten years the expense would be covered by the saving of life. . . . As to service, surely a regiment fresh from the hills would be worth two that had been demoralized and parboiled in the plains."

In the Report of the Royal Commission (1863) great stress is laid on the value of hill-stations. "For some years past the conviction has been growing that, in order to diminish the high rate of sickness and mortality, it will be necessary to remove a considerable proportion of the troops from low malarious plains and river-banks, and to station them on high tablelands or isolated mountains. . . . reduce to a minimum the strategic points on the alluvial plains, and hold in force as few unhealthy stations as possible."

In 1864 Parkes wrote: "Europeans can never be entirely free from the influence of malaria. There is but one perfect remedy; to lessen the force in the plains to the smallest number, consistent with military conditions, and to place the rest of the men on the higher lands. . . . In looking for healthy spots, where temperature is less tropical and malarious exhalations less abundant, there are only two classes of localities which can be chosen—seaside places and highlands. . . . Stations of elevation are the proper localities for all troops not detained in plains by imperative military reasons."

In 1868, Sir Ranald Martin wrote: "The natives of India, early in our career there, saw the supreme value of the mountain ranges to us, and expressed their surprise that we had not used them for the safety of our European troops. Hyder Ali, the most able and politic of all the native chiefs, felt amazed and was unsparing in his censures when he beheld the English commanders housing their white soldiers on the plains of the south. . . . His notion of treating the European soldier was to place him on the high cool regions; and thence to convey him in doolies into the plains, ready to be let slip on his enemies at the moment of action. . . . Montesquieu and other philosophers have observed that the condition of India, with its frequent military revolutions, were indeed the result of climate and of physical necessity, *the absence of a temperate zone*; that the conquerors inhabited the surrounding high grounds, and the slaves and the cowards occupied the plains. . . . In hill stations the British garrison of India can alone find security of health, and every soldier who can be spared from the duties of the plains should be placed there, the mounted branches occupying the various tablelands. . . . The British forces stationed on the hills should be made to descend upon the plains every cold season, there

to be perfected in the march and in the fire, the two requisites which, according to Marshal Ney, go to make a thorough and complete soldier. . . . The removal of the British garrison to the elevated ranges and cool climates has become what I venture to term 'a State necessity,' a necessity which must ere long demand a more extended State intervention. . . . I have long been impressed with the conviction that nothing short of a proved necessity can warrant the placing of any very large portion of the British garrison on the hot and pestilential plains of India."

Fifty-seven years later, in 1925, Major M. B. H. Ritchie, R.A.M.C., again brought forward, in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, this suggestion of removing men to the hills.

The possibilities of "cold storage" in the hills having been fully explored, a definite recommendation was made that troops located in malarious stations be withdrawn to the hills during August, September and October. Opposition was met with on all sides. It was objected that the provision of barracks in hill stations would require the expenditure of vast sums of money, that it would upset training, that it would be unfair to the troops and families in the non-malarious stations, etc.

Under continuous pressure difficulties began to diminish. When the available hill accommodation was accurately reckoned up it appeared that there was sufficient for all without building new barracks. The policy was modified so as to interfere with training as little as possible. It was pointed out that the hill accommodation would be reserved during only three months—August, September and October—for troops and families from malarious stations, while troops and families from non-malarious stations would have it for the rest of the hot weather. Conferences were held and objections dealt with. Eventually orders were issued that the scheme should be given a trial, and it was in fact adopted, but in a very modified form.

The results of the measures adopted in 1925, viz.: (*a*) Expenditure of a lakh of rupees, and (*b*) the partial use of "cold storage" (i.e., withdrawal to the hills) are indicated in the following figures:—

		Actuals		Rate per 1,000
Malaria admissions all India, 1924	..	12,120	..	206·8
,, ,, ,, 1925	..	9,124	..	159·0

The larger stations showing the highest incidence during 1924 are shown below, with the admission ratios for 1924 and 1925 contrasted:—

Stations			Malaria admissions per 1,000 1924		1925
Amritsar	..	..	1,172·7	..	825·7
Lahore	..	..	1,038·4	..	706·2
Delhi	..	..	487·2	..	259·1
Ambala	..	..	455·5	..	441·4
Multan	..	..	441·6	..	300 5
Ferozepore	..	..	427·6	..	284·0
Peshawar	..	..	398·2	.	386·4
Sialkote	..	..	381·0	..	345·4
Nowshera	..	..	303·1	..	253·4
Jhansi	..	..	235·4	..	161·3
Rawalpindi	..	..	226·3	..	158·9
Meerut	..	..	197·9	..	117·9

At the same time the number of malaria cases treated in barracks (including those "detained" for a few days in hospital) fell from 15,568, or 265·6 per 1,000 in 1924, to 11,480 or 200 per 1,000 in 1925.

There was thus a fall of 3,000 hospital admissions, or 47·8 per 1,000, and 4,088 barrack treatment cases, or 65·5 per 1,000. 1925 was, however, a "good" malaria year over the North of India, and there was no certainty that the measures adopted could in fact be credited with the whole or any appreciable part of the result.

It was clear that so long as malaria cases were treated out of hospital, or while "detained" for a few days, the results of centrally organized measures could not be accurately assessed. At the same time it was considered that thorough treatment of all cases *in hospital* would in itself constitute an antimalaria measure. During the following year practically all malaria cases were admitted to hospital, although the after-treatment was of course carried out in barracks.

Vigorous propaganda continued, both centrally and throughout the commands and districts. The Rockefeller malaria film was shown to all ranks and families. Schemes for 1926 were called for, and one and a half lakhs (about £11,000) sanctioned and distributed for ordinary antimalaria measures. Pressure was kept up to produce extension of the "cold storage" scheme, which was considered certain to be productive of good results; if men are away from malarious stations during the infective period, obviously they cannot become infected. Other measures might do much or little: "cold storage" was a certain winner.

During 1925 the question of "screening" or mosquito-proofing barracks had been under discussion. This method, used in many other parts of the world, had reduced malaria to a third or a fourth of its previous amount. While it was agreed that we might expect a similar reduction, the cost appeared to be prohibitive. Eventually it was decided to try it in one or two of the most malarious stations. Two lakhs of rupees were sanctioned for the British infantry barracks at Lahore, half a lakh for the British Military Hospital at Lahore, and half a lakh for the British infantry barracks at Amritsar.

Amritsar, in recent years the most malarious station in India, was "proofed" late in 1925, and the infantry barracks at Lahore in July, 1926.

The infective period of 1926 therefore found all the British troops at Amritsar, and the British infantry at Lahore Cantonment (Mian Mir), behind the protection of mosquito-proof wire gauze. "Cold storage" was more widely used. Propaganda and education were producing general enlightenment. More funds than ever previously were available for ordinary antimalaria measures in stations.

The results were awaited with great interest, and in the end gave cause for much satisfaction, tempered, however, by considerable disappointment.

Malaria admissions in the Northern Command (the most malarious and

the one on which we had concentrated) fell from 306·3 per 1,000 to 286·6 in 1926. This was, however, more than counterbalanced by the Western Command, where malaria broke out in epidemic form, played havoc with the civil population and caused an increase in the admissions from 155·4 per 1,000 in 1925 to 314·0 in 1926.

The net result was an increase on the previous year.

The factors affecting *hospital admissions for malaria* during 1926 were therefore :—

Favourable.	*Unfavourable.*
Extended use of "cold storage."	Epidemic malaria in Western Command.
Intensive propaganda.	
Intensive ordinary antimalaria measures—fumigation, drainage, oiling, closing wells, etc.	All malaria cases were admitted to hospital.
Favourable monsoon conditions in Northern Command.	
Screened barracks in Lahore and Amritsar.	

It could now be said, with considerable certainty, that the true incidence of malaria, or rather of malarial attacks (including relapses), was definitely known. It was 165·3 per 1,000 in 1926.

In 1927 "cold storage" was still further developed. A small portion of the barracks in Delhi Fort and in Peshawar was mosquito-proofed. Fumigation was more universally employed. Propaganda continued at full pressure. Interior economy and discipline in units was kept up with regard to the use of nets, fans, punkhas, etc. Ordinary antimosquito measures were carried out more intensively than ever at an expenditure of two lakhs of rupees (£14,000).

The results have been most satisfactory and show a further considerable fall in hospital admissions for malaria, viz., from 165·3 per 1,000 in 1926 to 138·8 per 1,000 in 1927.

This represents with fair accuracy the true ratio of malaria incidence—or rather malaria attacks—and in all probability compares favourably with the true ratio in any previous year.

MALARIA—BRITISH TROOPS.

Year	Hospital admissions		Barrack treatment	
	Actuals	Per 1,000	Actuals	Per 1,000
1924	12,120	206·8	15,568	265·6
1925	9,124	159·0	11,480	200·1
1926	9,388	165·3	10,928	193·4
1927	7,723	138·8	8,819	158·5
Decrease since 1924	4,397	68·0	6,749	107·1

Hospital admissions were therefore 36 per cent less, and cases treated in barracks 43 per cent less, than in 1924.

It may be of interest to review shortly the case of Lahore Cantonment (Mian Mir), perhaps the most notorious of all Indian stations.

The attention of Indian malariologists had long been centred on this cantonment, perennially unhealthy on account of malaria.

In 1898 the admission rate for this disease was 2,000 per 1,000. In 1900

it was 1,059 per 1,000. Wide fluctuations occurred from year to year. In 1921 it was 714, and 1,077 in 1923.

Commissions had been sent by the Royal Society (1901-03), and by the Indian Government (1909); large sums of money had been spent, irrigation had been introduced, stopped, and re-introduced; questions were asked in Parliament; distinguished malariologists made visits; even the name was changed from "Mian Mir" to "Lahore Cantonment"; but the malaria situation remained as ever, completely out of hand.

The cantonment area is as flat as a pancake, and effective drainage is impossible except at a very heavy initial and recurring expenditure.

"Cold storage"—introduced in 1925, and partial mosquito-proofing—carried out in 1926, have shown that the problem is not insoluble.

Lahore Cantonment.

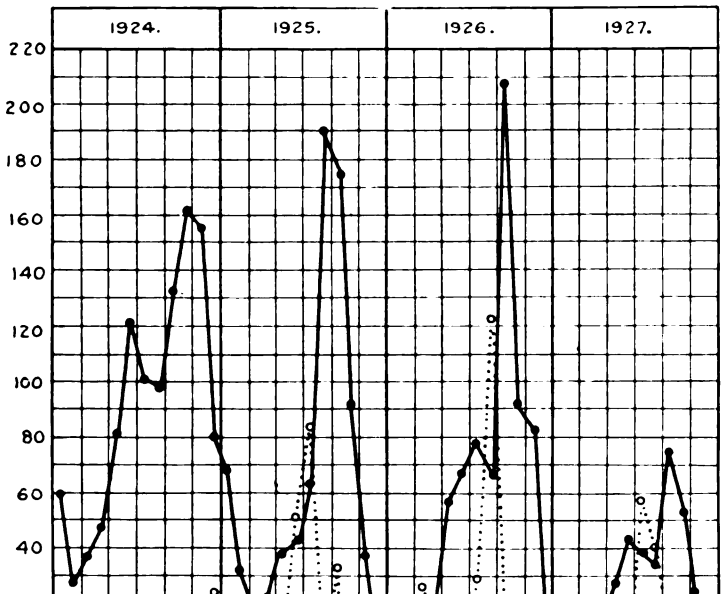


Fig. 4.—Malaria admissions, British troops. Black line = ratio per 1,000. Dotted line = rainfall (one square = one inch).

Lahore Cantonment (Mian Mir.)

Year		British Infantry			Other British Units		
		Strength	Admissions	Ratio per 1,000	Strength	Admissions	Ratio per 1,000
1923	..	692	911	1,316.5	488	360	737·7
1924	..	631	791	1,253·6	412	292	708·7
1925	..	625	434	694·4 [1]	396	287	724·7
			Proofed July, 1296.				
1926	..	620	232	374·2	415	403	971·1
1927	..	626	66	105·4	463	212	457·9

[1] Cold storage introduced.

As funds become available it is proposed to complete the mosquito-proofing of all British barracks in Lahore Cantonment, which should then become one of the healthiest stations on the plains of India.

In Amritsar the effects of mosquito-proofing are equally remarkable :—

AMRITSAR.

Year	Malaria admissions per 1,000 British troops
1923	564·4
1924	1,172·7
1925	825·7
Proofed late 1925.	
1926	244·3
1927	93·6

As a result of four years of central control a definite policy—suited to military needs—can now be formulated as follows :—

(1) "Cold storage" of troops, i.e., withdrawal of as many as possible from malarious stations to the hills during the infective season (August to October).

(2) Mosquito-proofing of barracks for residual troops in malarious stations, i.e., for those who must perforce remain during the infective period and for those who must come down early in October for training purposes (cavalry and artillery).

MALARIA.

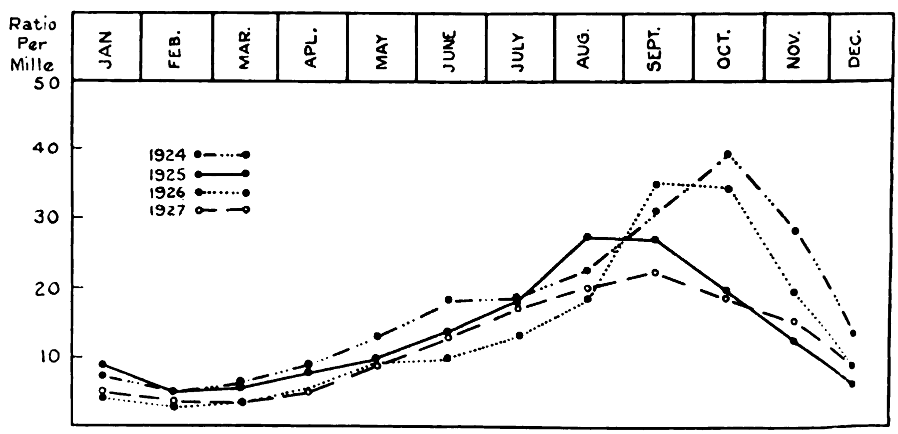


FIG. 5.—British troops—monthly admission ratios per 1,000.

(3) Fumigation of barracks at the end of the cold weather to destroy infected hibernating mosquitoes, and again at intervals until the onset of the next cold weather.

(4) Propaganda and education by means of lectures, demonstrations and cinematograph films.

(5) Measures of interior economy and discipline in units, e.g.: (*a*)

Proper care and use of mosquito-nets in unproofed barracks; (*b*) full use of fans and punkhas to ensure movement of air; (*c*) use of repellents (paraffin-citronella oil, etc.), by men on guard, transport personnel and others on duty after sunset or before sunrise; (*d*) "shorts" not to be worn after sundown; (*e*) placing of known infected areas out of bounds.

(6) Antimalaria measures such as minor drainage schemes, closing of unused wells, oiling, use of Paris green, trapping and swatting of adult mosquitoes, use of spot-maps, etc.

(7) Efficient lighting of barracks—electric light instead of kerosene lamps.

(8) Effective treatment of malaria cases. The exhibition for a few days of *plasmochin-compound plus quinine* appears to hold out the best hope of eradicating the parasites and effecting a permanent cure. This method is under trial.

(9) Co-ordination of all measures in each malarious station under a specially appointed malaria officer.

Of these measures "*cold storage*" and *mosquito-proofing* are certain winners and should be exploited to the fullest extent possible.

Space will not permit of a discussion on the economic side of malaria prevention; it may, however, be confidently asserted that—apart from the saving in life, invaliding, sickness and inefficiency, training days and general health—the measures outlined above are economically sound, and viewed merely as a financial proposition will in a few years repay with compound interest the outlay they demand.

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(*To be continued.*)

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NOTES ON THE HISTORY OF THE MEDICAL STAFF CORPS AND ARMY HOSPITAL CORPS, 1854-1898.

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Royal Army Medical Corps.

(*Continued from p.* 277.)

The Transvaal War, 1880-1881.[1]

The Transvaal was annexed as British territory in April, 1877. On December 16, 1880, the malcontent Boers threw off their allegiance, hoisted the flag of the South African Republic at Heidelburg and assembled in arms. The military forces in South Africa had been brought down to a peace footing, most of the transport and ordnance stores collected for the late campaigns had been sold, and all warlike material was deficient. In the Transvaal there were three infantry battalions dispersed in small garrisons, the 21st, 58th and 94th, while the troops available in Natal to form a striking force did not exceed 1,400.

The P.M.O. in South Africa, Surgeon-General J. L. Holloway, seems to have been one of the few who were not caught unprepared. For six weeks before the outbreak he had engaged himself in the assembly of medical stores, replenishment of panniers, and securing the repair of the heterogeneous collection of ambulance wagons which were available. As a result, the medical assistance provided for the small force which it was found possible to concentrate seems to have met all requirements.

Hostilities commenced on December 20 with the surprise and destruction of a detachment of British troops, consisting of the headquarters and two companies of the 94th Regiment, under Colonel Anstruther, who, with band and colours, were peacefully marching from Lydenburg to Pretoria. The medical staff with the party comprised Surgeon E. C. R. Ward and four other ranks of the Army Hospital Corps.

When the force was approaching Bronkhorst Spruit a Boer appeared with a white flag and told the Commanding Officer that the column must return. On the latter's refusal, fire was opened from a carefully concealed ambush. The men were ordered to extend, and an attempt was made to return the fire, but within a quarter of an hour all the officers except the paymaster were hit, fifty-six men killed and 100 wounded, among the last being two of the A.H.C. The medical officer escaped with a flesh wound of the thigh. The Colonel, mortally wounded himself, then surrendered. The unwounded survivors were marched off by the Boers, with the exception of twenty-five who were left with the M.O. to bury the dead and attend to the casualties. A wounded transport conductor, who was permitted to ride off for

[1] The medical reports of this campaign are to be found in A.M.D. Report, 1880.

assistance, took the opportunity to carry away the colours concealed under his coat.

Surgeon Ward was allowed to remove his medical equipment from the wagons and to set up some tents on the spot. In the camp thus established he remained for more than three months. Meanwhile, besides the care of the wounded and the burial of the dead, the feeding of the whole party devolved on him, and, as a start, he decided to kill one of the oxen left him by the Boers to draw the water cart. The ox was converted into beef tea, and some eggs and milk were procured on payment from a neighbouring farm.

No assistance reached him until the 22nd when Surgeon Major Comerford, Civil Surgeon Crow, and six men A.H.C., arrived from Pretoria with transport, and the more urgent capital operations were performed. Of the wounded, sixteen men and four officers died. On the 23rd, nine patients were sent to Pretoria and on January 4 ten more. The Surgeon Major left with the second convoy, after which the camp was entirely cut off, Pretoria itself being invested. The Boers appeared from time to time, and carried off some of the convalescents as prisoners, but otherwise the two medical officers were left to their own devices. The camp was shifted to a more satisfactory position on the river, and the wounded were made as comfortable as circumstances would permit. There were three women and two children with the troops, who remained at camp during the period of occupation. One woman, referred to as wounded, must be Mrs. Fox, the serjeant-major's wife, who is said to have helped to conceal the colours after the surrender by lying on them. Another, Mrs. Smith, widow of the dead bandmaster, whose child was wounded, bound up some of the wounded men under fire, tearing off bits of her dress to make bandages. She was decorated on her return to England.

The supply of food was a difficulty. On one occasion Ward had to ride forty miles to Middelburg to buy rations. The party were allowed to join their friends on April 1.

In January all the posts held by British garrisons were besieged. The defence put up by the various small detachments of one or two companies in these isolated positions was one of the few redeeming features in this disastrous campaign. In every case the medical staff emerged with credit. At Potchefstroom, where the two companies of the 21st under Colonel Winsloe lost a third of their strength, Surgeon K. S. Wallis, with Corporal Stanley and three other ranks, A.H.C., though all disabled by wounds or sickness, did meritorious work. At Standerton, Surgeon Majors Parkinson and Fraser, Surgeon Lloyd, and five of the A.H.C. were favourably mentioned. At Marabastadt, Surgeon A. Harding was in medical charge. At Lydenburg, where a particularly gallant defence was conducted by a subaltern and a company of the 94th, the hospital was constantly under fire, and three out of the four orderlies were wounded. For three days, while the officer commanding the detachment was incapacitated by wounds,

Surgeon John Falvey carried on the defence. The Boers meanwhile invaded Natal, taking up a strong position on the Drakensberg. Sir William Colley, the Governor and High Commissioner of the Cape, collected a force consisting of the 3/60th, 58th, six guns, sixty-one mounted infantry and a few of the King's Dragoon Guards. This force was joined by a small Naval Brigade and rocket battery of ninety men. A base hospital under Surgeon Major A. H. Stokes was established at Newcastle, and accompanying the troops were Surgeon Major T. Babington (S.M.O.) with Surgeons J. Ring, J. McGann, A. J. Landon, and E. E. Mahon of the Royal Navy. With them went a field hospital and twenty-two men of the A.H.C. The bandsmen of the infantry had been trained as stretcher-bearers, and were supplemented by thirty-eight native bearers.

Colley's force advanced to Prospect Camp from whence, on January 28, an attack was launched on Laing's Nek. After an hour's preliminary bombardment, the mounted troops endeavoured to occupy a hill on the right of the position, but were repulsed with the loss of their commanding officer. The charge is familiar in Lady Butler's picture, "Floreat Etona." The 58th reached their objective on the summit of a high hill, but were forced to retire. Surgeon McGann followed the regiment with 12 bandsmen, 20 native bearers, 8 A.H.C. and 12 stretchers, Surgeon Ring was attached with a similar party to the Rifles, but they were hardly engaged. During the withdrawal, the two medical officers with their parties advanced through the retiring troops and proceeded up the hill under heavy fire. The enemy, having removed their arms, allowed them to attend the wounded, and eventually to remove them to the aid post. From here they were transferred to the field hospital in camp, and eventually, by the courtesy of the Boers, who had cut our communications, to Newcastle. Our casualties were seventy-five killed and 123 wounded. The Boer casualties were negligible. It is said that surgical aid was offered to the enemy after the engagement and accepted, but the fact is not mentioned in the medical report of the battle.

On February 3 a reinforcement of two companies of the Gordons arrived in camp, and on the 8th the battle of Ingogo was fought. Leaving a company and two guns to guard the drift, the General crossed the river with a force of about 380 men. The Boers engaged at a range of 700 yards and could not be brought to close quarters. They kept carefully under cover, and our men, conspicuous in their scarlet, blue, or green tunics, and white helmets, were shot down almost without getting a sight of the enemy. The river was with difficulty recrossed after dark, leaving sixty-three dead and seventy-five wounded on the ground, with Surgeon McGann, four stretchers and twenty native bearers. Surgeons Ring and Landon, who were dispatched from headquarters with ambulances and stretchers as soon as the firing commenced, were held up by the Boers, but reached the battlefield during the evening. All through the night, amidst streaming rain and bitter cold, the wounded were searched for and collected. McGann received the thanks of the General in column orders.

By this time reinforcements had arrived in Natal, and Sir William Colley was actually in touch with General Evelyn Wood at Newcastle. On February 27, finding that Majuba Hill, which commanded the enemy's position, was unoccupied, he decided to seize it during the night, and at 9 p.m. the S.M.O. received orders to provide medical personnel for the force consisting of 150 men of the 58th, 150 of the 60th Rifles, 180 Gordon Highlanders, and 65 Bluejackets, who were marching in half an hour's time. Surgeons Landon and Mahon, with a pack horse and an N.C.O. and three men, A.H.C., were detailed to accompany the main force, and Surgeon Cornish, with a serjeant and two men, to medical charge of the two companies of the 60th, which were to be dropped to form an intermediate post between the camp and the summit of the hill. The summit was reached at about 5 a.m., and the exhausted men were allowed to lie down and sleep. No entrenchments were thrown up, and apparently the defensive positions were wrongly sited. The details of the fight that ensued that morning are sufficiently familiar, ending with the death of General Colley, and the complete rout of the force.

When the Boers made their final charge, Landon, together with Privates Farmer, Sealey and Frost, were engaged in attending to a wounded man. The surgeon ordered his men to lie down, and was almost immediately shot through the chest. Farmer endeavoured to protect the wounded by waving a triangular bandage over his head, and was shot through both arms in the attempt. In spite of this, he pluckily attempted to carry on with his duties. For his generally gallant conduct during the day he was awarded the V.C. Private Sealey received wounds in both shoulders. Surgeon Mahon, R.N., who was unwounded, remained on the summit with the A.H.C. men after the position was captured, and attended to the wounded all night.

At mid-day, hearing heavy firing going on, the S.M.O. sent all available ambulances away under Surgeon Ring, with orders to establish an aid post as far as possible up the mountain, and during the afternoon he himself proceeded to the spot, where, after obtaining the permission of the Boer General, Smut, he and Ring searched the slopes. Here many casualties were collected, including Surgeon Major Cornish, mortally wounded in the chest, who, with others, was conveyed to a temporary field hospital improvised at Neil's Farm at the foot of Majuba, and about four miles from camp. According to eye witnesses, Cornish was himself assisting in the carriage of a patient and had sat down by the stretcher to rest. Seeing a party of Boers approaching, he waved a white handkerchief tied to his stick, calling out "wounded men." At that moment he was shot, and rolled several yards down the hill.[1]

There was a dense fog at night, and it rained and blew hard. Lanterns

[1] The stick, which was perforated by the bullet which caused the fatal wound, is preserved in a case in the R.A.M.C. Headquarters Mess.

were useless, and only when morning broke could the work of clearing the wounded be commenced. It was with difficulty completed by nightfall, and Surgeon Ring had to spend a second night on the summit with a few serious cases. The two wounded medical officers died on March 1.

During the period in which Colley's force was in being, fifty capital operations were performed at the field hospital at Mount Prospect, and at the base hospital at Newcastle. It is interesting to note that of these thirty-nine were amputations. The wounded were eventually evacuated to Pietermaritzburg through Ladysmith, but the work was rendered difficult by swollen rivers and bad roads. Brigade Surgeon E. M. Sinclair now became P.M.O., at Newcastle. On March 12 an armistice was conducted between General Evelyn Wood and the Boers, on March 23 peace was declared, and the Transvaal granted independence. By this time there were ample troops in the country, among the reinforcements being a complete bearer company, under Surgeon Major W. Johnston, which had arrived at Durban on February 26. The company, which had been trained at the depot at Aldershot, consisted of 8 officers A.M.D., 3 officers of orderlies, 1 serjeant-major, 4 staff-serjeants, 3 serjeants, 13 corporals, 2 buglers, and 118 privates A.H.C. A warrant officer and 18 other ranks of the A.S.C. were attached, but were subsequently replaced by native drivers. The transport sent out was half pack and half wheeled. The men were supplied with carbines.[1]

After the armistice there was for some months a considerable military force in the country. Certain rumours adversely reflecting on the general conduct of the A.H.C. orderlies in the hospitals during the period were investigated during the sitting of the parliamentary committee on the Corps held two years later. Charges of drunkenness, neglect of duty, appropriation of hospital comforts ordered for patients to their own use, etc., were made, and a particularly cruel suggestion came from a lady, whose services as a nurse had been offered and declined, to the effect that many of the deaths from enteric in one of the hospitals were due to neglect on the part of the nursing orderlies. The last was sufficiently disproved by the Director-General. The remaining complaints, where substantiated, were traced to one or two men whose conduct brought undeserved discredit on the whole. The committee found that the more serious allegations were not established, but recorded their opinion that improved nursing arrangements were both possible and desirable. Sir Evelyn Wood, who always treated the medical services with justice, implied in his remarks that the general conduct of the A.H.C. men was much the same as that of other soldiers, which was only to be expected in a Corps whose ranks were filled from the same class of the population. In view of the special duties required of them, it was undoubtedly desirable that a high stamp

[1] *Vide* JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, Vol. xvii. "The Second Bearer Company," Colonel W. Johnston, C.B.

of man should be enlisted. To attract such men the prospects offered on joining might have to be improved. Colonel Redvers Buller laid stress on the value of lady nurses to supervise the men's work, the principle now accepted in our hospitals. In 1881 the officers of orderlies were gazetted as quartermasters.

The Afghan wars of 1878-80, which absorbed a large number of A.M.S. officers, are beyond the scope of these notes. The Indian regiments retained the regimental system, which survived well into our own time; the British had field hospitals. As a result of the experience of the war, the Indian A.H.C. was formed to supply native personnel for the British hospitals, and steps were taken to organize and train the dooly bearers in time of peace. Surgeon-General Crawford's medical report of these wars will be found in the A.M.D. Report, 1880.

The Egyptian Campaign, 1882.[1]

We now pass to Sir Garnet Wolseley's campaign in Egypt in 1882 in which 163 medical officers and about 820 of all ranks of the A.H.C. were engaged, the object being the suppression of the revolt of the Egyptian army under Arabi Pasha. The expeditionary force consisted of two divisions, a cavalry division, and corps troops, with an Indian contingent (British and Native) about 6,000 strong. The ranks of the A.H.C. were partially completed by volunteers from the infantry reservists.[2] The conduct-sheets of many of these men, when they eventually reached the hands of the medical authorities, were found to be far from satisfactory, and they seem subsequently by their behaviour to have brought a good deal of undeserved discredit on the Corps. Eight field hospitals were provided, five of them intended to be mobile, and two bearer companies with pack equipment and six light two-wheeled carts as well as mule cacolets. The steamship "Carthage," specially fitted up for 220 beds, was intended to form the first dieted base hospital from which transports were to take the sick to hospitals established at Gozo and Cyprus, and to England. As events turned the "Carthage" and transports were hardly used, and base hospitals had to be improvised in the country.

The bombardment of Alexandria took place on July 11. In August the expeditionary force arrived and was disembarked. On August 18, the whole of the 1st Division was ordered back on board ship. The principal medical officer, Deputy Surgeon-General Hanbury, was not apparently taken into the confidence of the Commander-in-Chief, being, as Sir Garnet described it, the head of a department, and in no sense attached to his staff.

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[1] Deputy Surgeon-General Hanbury's account of the expedition is in A.M.D. Report, 1881.

[2] The infantrymen seem to have formed a large proportion of the Bearer Companies. The personnel is described in a Blue Book of 1883 as 8 officers, 3 quartermasters, 36 A.H.C., 95 bearers, 11 batmen, and an officer and 59 O.R. Transport Corps.

The only reference to medical affairs to be found in the general order issued was to the effect that "Every battalion, regiment, or battery will be accompanied by two medical officers and a field medical pannier," which, had it been observed, would have completely upset the system on which the whole medical organization was based.

The transports entered the Suez Canal, and on August 20, the division disembarked without tents at Ismailia. Nefiche Junction on the railway was occupied, and by the 26th after some light opposition our advanced troops held Kassassin lock on the Sweet Water Canal (fig. 1).

The heat was intense, the fine shifting sand rendered the movement of any wheeled vehicle difficult, and the transport which was supposed to be

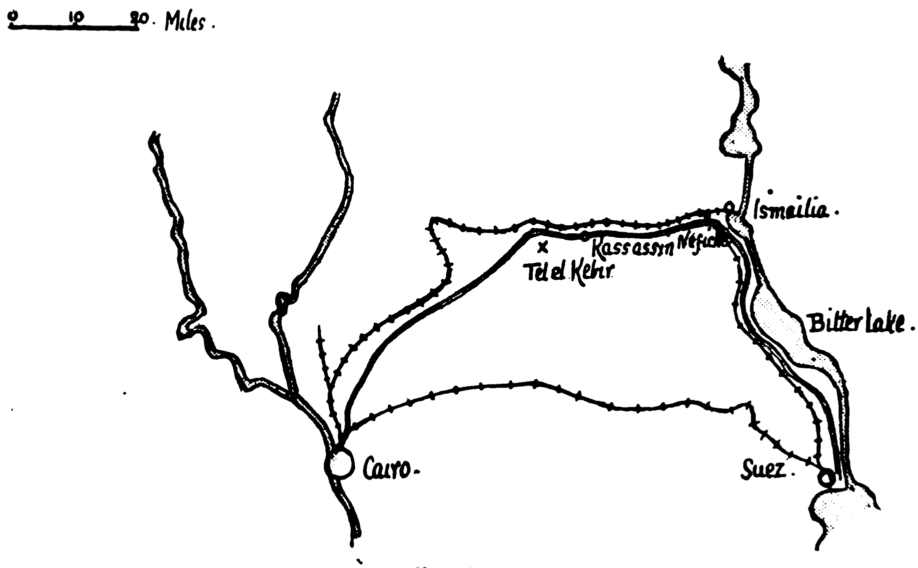

Fig. 1.

allotted to the medical service was for several days employed on other duties. The medical equipment came in bit by bit, and was disembarked and carried up to the hospital in the Khedive's palace by the A.H.C. At the same time they had to get ready the place for the reception of patients, supply stretcher parties for local sick, and collect the rations from the store depot. Fighting began within thirty-six hours of landing, and casualties had to be dealt with. The work was extremely arduous. The hospital was started with the staff of one of the mobile field hospitals assisted by a bearer company. Owing to the late arrival of the bulk of the stores it was not fully equipped until the 28th, when it had accommodation for 500 patients, and contained the material of No. 4 Mobile and Nos. 7 and 8 Stationary Field Hospitals.

Meanwhile medical assistance to the front line was got up with difficulty.

On the 24th a section of No. 3 Field Hospital was dragged to the station in carts by the men in the evening, and entrained, reaching its destination at El Magfar, seven miles away, the following morning; No. 1 Bearer Company marched to the same destination without transport. Mule transport was however provided for a section of the second company. It was not till the beginning of September that enough mules were provided to partially complete the transport of the two bearer companies; the hospitals were never moved otherwise than by rail or water. The Indian contingent, with Deputy Surgeon-General S. G. Colvin Smith as P.M.O., had their hospital at Nefiche. They brought three bearer companies of Kahars with doolies and dandies, who are said to have done admirably.

General Graham's force was strongly attacked at Kassassin on the 28th, and was in some peril till reinforced by a cavalry brigade in the evening. No. 1 Bearer Company had reached the lock house at that place in time to take part in the engagement, and established a dressing station from which wounded were evacuated by boat to Ismailia. Surgeon Major Shaw, the senior officer present, was killed early in the day, after which Surgeon Major Corban assumed command. The dressing station came under shell fire, and a bearer and an officer patient were wounded. At the most critical part of the action the bearers got separated from the fighting troops with a number of wounded on their hands. The men were ordered to fill their haversacks with sand to form a parapet, rifles were borrowed from the wounded, and the enemy were successfully held off till the arrival of the cavalry. Our losses in this engagement were fifteen killed and ninety wounded. A second engagement was fought at Kassassin on September 9, by which date No. 3 Field Hospital had come up and was established in the lock house.

The headquarters of the 2nd Division having reached Ismailia on September 1, arrangements were now made for a general attack on the enemy's position at Tel-el-Kebir, a line of trenches $2\frac{1}{2}$ miles long, at right angles to the railway and the Sweet Water Canal, held by 38,000 troops, with sixty guns. The operation, which involved an advance of $6\frac{1}{4}$ miles over open, undulating, but firm ground during the night, and an attack at dawn, was carried out with complete success on August 16-17. Our casualties in a force of 15,000 were 58 killed and 379 wounded.

Two complete field hospitals were employed as a main dressing station at Kassassin. Half a bearer company, reinforced with such extra transport as was available, followed each of the two divisions under Surgeons Major Ray and O'Dwyer, and an advanced field hospital (i.e., a dressing station) went with them carrying some tents. The staff of the hospital consisted of 9 medical officers, 3 officers of orderlies, and 17 men A.H.C. The Indian contingent had their Kahars with 80 doolies and dandies; for the cavalry there were 25 cacolets on horses. The advanced dressing-station party pitched their tents on the canal bank, and wounded were sent down in boats and pontoons manned by the Royal Navy, first to Kassassin and then

on to the sick transports. Some of the lighter cases were evacuated by freight train. The A.H.C. worked well on into the night before all the wounded were cleared. All went off without a hitch. Sir Garnet Wolseley subsequently stated: "I never saw wounded men better cared for than the men after Tel-el-Kebir. The removal of the wounded was very well done."

The victory was promptly followed up. On August 15 Cairo was occupied. The rebellion had been suppressed in twenty-five days.

It was now necessary to provide hospitals for the troops at Cairo. A camp hospital was opened at Ghezireh, and others were established in Abassiyeh Barracks and in the Citadel, the last being taken over in an indescribably filthy condition. They were equipped with the authorized field hospital equipment, and staffed with field hospital personnel. Such amenities as beds were secured, in so far as the Ordnance Department were able to provide them, but it was not able to give much assistance in that line. Equipment was wired for from Cyprus, and arrived somewhat late.[1] These hospitals, and the hospital at Ismailia, came in for a good deal of unfavourable criticism. The absence of the full complement of beds, fly whisks, and mosquito-nets, was commented on at an inspection by the Commander-in-Chief. Many of the sick expected to find invalid cooking, and something more than rough-and-ready nursing, and did not conceal their disappointment. The medical staff, who were doing their best with the facilities provided, had no doubt much to learn in organization and the exercise of initiative, but had to endure abuse for things for which they were in no way answerable. Sir William MacCormac, who understood what the running of a large hospital meant, and had known the hospitals of the Franco-German war, was warm in his praise of what the medical service was able to accomplish, and strongly hinted that if unmerited abuse was to be the reward of devoted service in the field, the Government must not look to the great medical schools for their Army Surgeons in the future.

The war brought out the fact that the organization of the A.H.C. was defective. The men had shown bravery in the field, and the collection of the wounded was well done, but the nursing in the field hospitals was undoubtedly a fair object of criticism. Their want of discipline was also commented on. The conclusions reached by the Parliamentary Commission, under the presidency of Lord Morley, the following year were, that during the late war the sick in many cases were not treated by the orderlies with sufficient care and attention; that there was want of nursing control, due to absence of graduated supervision from the medical officers downwards, and that their peace training was not carried out on the right lines.

Sir Garnet Wolseley, while he gave the doctors credit for devotion to duty, wished them always to remain doctors, and had no use for them in any other capacity. His panacea for the A.H.C. was control by combatant

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[1] The sick admission-rate worked out at 2,379 per 1,000 per annum, largely due to enteric, dysentery, and ophthalmia.

officers. Fortunately, the Commission did not take this view. Their suggestions for improvements, most of them subsequently carried out, were, on the whole, greatly to the benefit of the medical service.[1]

The A.M.D. and the A.H.C., "a department without subordinates, and a Corps without officers," should be amalgamated into a Royal Corps. Its ranks should be open to all classes, except reservists, but suitable men might still volunteer from the Line. Three sections—a nursing, a steward's, and a general duty section—should be formed, the first two with two grades of orderlies and better pay. Schools of cookery to be formed at Netley and Woolwich. Military drill to be subordinated to technical training, and opportunity to be given for practice in peace with war equipment. It was strongly recommended that nurses should be employed at all the larger hospitals at home and in the base hospitals in war. Among other points touched on was that general officers should be impressed with their responsibilities in inspecting their hospitals. Prior to this date, beyond an occasional visit to the patients, many of them had left the matter severely alone, and were profoundly ignorant of their methods of working. The example set later by Sir Evelyn Wood and the Duke of Connaught, at Aldershot, greatly helped the medical service, and enabled them to feel that their difficulties were understood.

The honours received by the officers of the A.M.D. in this campaign were as follows: K.C.B. 1, C.B. 1, Knighted 1, Medjidie 8, Osmanieh 4. There were 17 mentioned in dispatches, and 7 special promotions were made. There seems to have been a feeling in the medical profession that the services of the Army surgeons were imperfectly recognized.

The Soudan Expeditionary Force, February-April, 1884.

The position we now occupied in Egypt involved us almost immediately in the affairs of the Soudan, which, being Egyptian territory, was overrun by the Arab forces under the Mahdi and his general, Osman Digna. After two Egyptian armies led by British officers had been cut to pieces, a British force of about 5,000 men under Sir Gerald Graham was collected at Trinkitat on the Red Sea, with the idea of relieving the Egyptian garrisons in Tokar and Sinkat. The medical personnel comprised fourteen M.O.'s and sixty-eight A.H.C., part of whom were employed on the hospital ship "Orontes" (300 beds), and part at a base hospital established at Suez. The remainder formed the staff of a mobile field hospital which accompanied the force. The P.M.O. was Brigade Surgeon E. G. M. M'Dowell. At the battle of El Teb, fought on February 29, 1884, Surgeon Stuart and twenty-seven of the A.H.C. were present, in addition to the regimental medical staff.

The whole of General Graham's force subsequently re-embarked for Suakin, which was being threatened by the Mahdi. An advance was made

[1] Parliamentary Commission on Army Hospital Corps Administration, 1883 [c. 3607], xvi, 1.

to Tamai where the enemy were engaged on March 13. In this campaign, when a battle was expected, the main portion of the field hospital usually remained in the zariba occupied by the force during the night, while the rest of the medical personnel accompanied the troops in brigade square formation, with stretchers and cacolets. As the squares were constantly

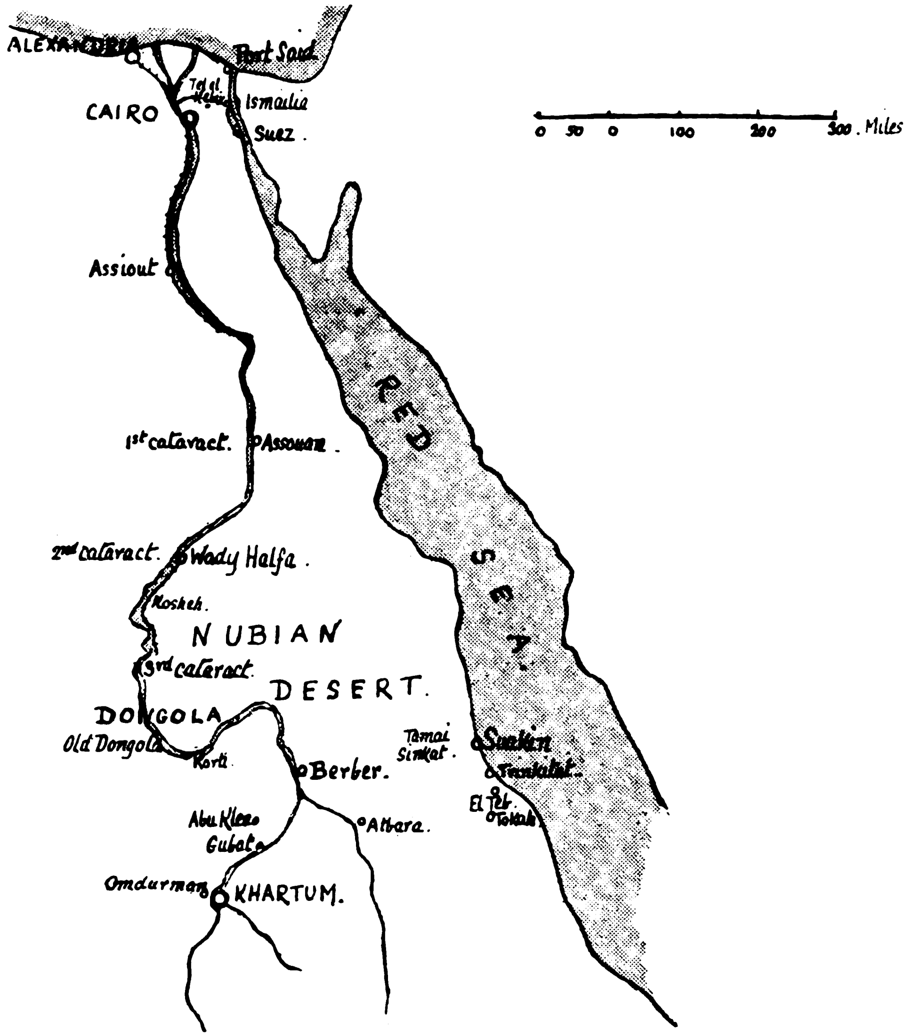


Fig. 2.

changing their position, the A.H.C. were frequently engaged in bringing wounded back to safety inside the square. The severe punishment the enemy received was not effected without considerable losses on our side. The evacuation from the field hospital was effected mainly in mule cacolets and on stretchers borne by natives, but in the latter part of the

campaign four ambulances and some Maltese carts were available. The severely wounded and sick from Tamai were carried a part of the way to Suakin by bluejackets from the Fleet. The experiences of the war again emphasized the need for transport animals definitely allotted to medical units.

This year the officers of the Army Medical Department and the quartermasters of the A.H.C. were designated "Army Medical Staff," while the A.H.C. other ranks became "Medical Staff Corps." About the same period the scarlet uniform, hitherto worn by the medical officers, was discarded in favour of a blue tunic with black velvet facings and scarlet shoulder knots. The only change made in the men's uniform was an alteration in the lettering of the cap badge, and the provision of a Tudor crown on the collar.

(To be continued.)

PILGRIMAGE OF THE BRITISH LEGION TO THE BATTLE-FIELDS.

By Colonel A. CHOPPING, C.B., C.M.G.

The 8th of August—a never to be forgotten day; the day the tide turned for the British armies in France. How better to celebrate the tenth anniversary than by a pilgrimage to France and Belgium, to visit the battle-fields and take part in the Commemoration Service at the Menin Gate, Ypres.

The pilgrimage, organized by the headquarters of the British Legion, started from the various legion centres in England, Scotland, Wales and Ireland, and nearly 11,000 pilgrims, of whom about one-third were women, joined in this memorable visit to the scenes of trench warfare and also, in a large number of cases, the grave of some fallen relation.

The arrangements made for the pilgrims worked according to plan. They were trained from their centres in batches of 500 to Dover, crossed over to Calais and were taken by special trains to their destinations in France or Belgium, viz., Amiens, Tourcoing, St. Omer, Valenciennes, H. Lietard, Arras, Lens, Douai, Roubaix, Bethune, Hazebrouck, Cambrai, Lille, Armentières, Ypres and Poperinghe, where they were billeted in private houses by the kindness of the French and Belgian eople, or in hotels.

The boats crossed over to France on the evening of August 4-5, and all the pilgrims were comfortably settled in their billets the next day, Sunday, ready for an early start on the Monday morning to the battle-fields.

The general idea of the pilgrimage was that all pilgrims should visit Vimy Ridge one day and Beaucourt the next, and that on the Wednesday all should concentrate at Ypres to take part in the Commemoration Service at the Menin Gate. The return to England to be direct from Ypres in the evening. For this purpose arrangements were made with the French and Belgian railway authorities for special trains to convey the pilgrims from the town in which they were billeted to Vimy, Beaucourt and Ypres, and to bring them back in the evening. The pilgrims were given their breakfasts and evening meal in their billets and a "carton" lunch was supplied by "Felix Potin," the Lyons of France, and was excellent, consisting of cold ham and beef, roll of bread, one tomato, one banana, Gruyère cheese, a bottle of mineral water or beer, a small knife and fork and paper cup and plate.

On arrival of the pilgrims at Vimy or Beaucourt Station, they were handed their lunches. They then proceeded to walk to the ridge in the case of Vimy, or to Thiepval or Newfoundland Park in the case of Beaucourt. Motor cars and charabancs were provided for those who

were unable to walk and for those who wished to visit any outlying cemetery.

A certain number of the parties were accompanied by their own doctors, but medical arrangements were necessary in the towns in which the pilgrims were billeted and also at Vimy, Beaucourt and Ypres. Therefore previous arrangements had been made with French or Belgian doctors to give any medical advice required in billets and for admission to local hospitals if necessary. For the battle-fields a medical unit was sent out by the British Red Cross Society, consisting of :—

1 officer, late R.A.M.C. (P.M.O.).
2 doctors.
1 quartermaster.
1 matron.
3 V.A.D. nurses.
8 B.R.C. orderlies.
2 Ford ambulance cars (with lady drivers).
1 heavy ambulance car (joined the unit in France).

This unit was located at Arras, and was divided into two as under for work at Vimy and Beaucourt :—

Vimy Unit:—

1 doctor.
2 V.A.D. nurses.
4 B.R.C. orderlies.
1 Ford ambulance car.

Beaucourt Unit:—

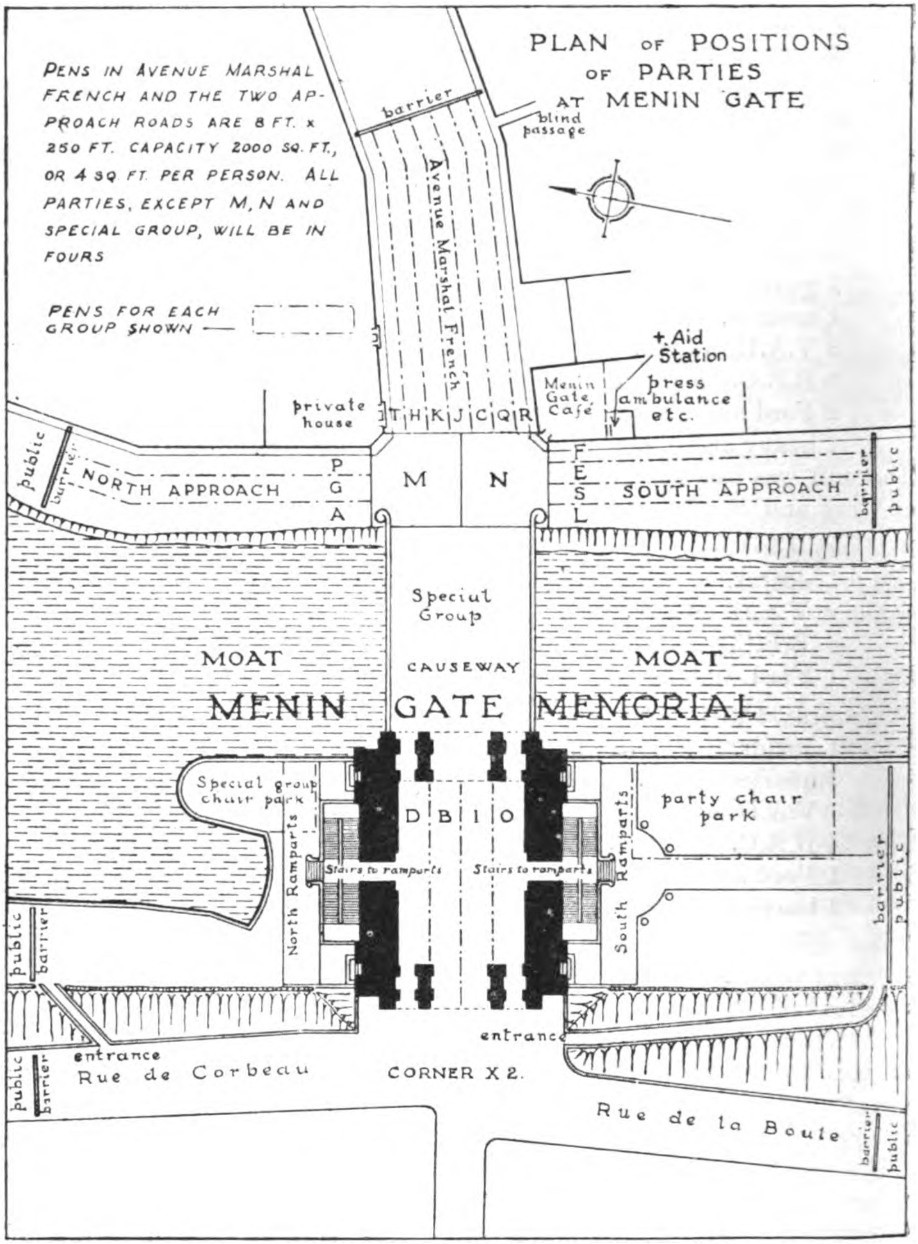
1 doctor.
1 quartermaster.
1 V.A.D. nurse.
4 B.R.C. orderlies.
1 Ford ambulance car.
1 heavy ambulance car.

These medical units went out from Arras to Vimy and Beaucourt in sufficient time to establish their aid posts before the arrival of the first train load of pilgrims.

At Vimy an aid post was located in a hut in the station yard and was attended by quite a number of patients complaining of minor ailments; a second post was stationed half-way up the hill, about one mile from the station, and a third at the top of the ridge amongst the Canadian trenches.

Provision was made to deal with accidents from bombs and shells, of which a number still lie in this area of 250 acres bought by the Canadian Government and left as it was when the fighting ended. Here the Canadians fought and it is here their Memorial is being erected. Fortunately no such accident occurred, and only minor cases were treated.

It was a wonderful sight, this gathering of the pilgrims on Vimy Ridge


PLAN OF POSITIONS OF PARTIES AT MENIN GATE
PENS IN AVENUE MARSHAL FRENCH AND THE TWO APPROACH ROADS ARE 8 FT. x 250 FT. CAPACITY 2000 SQ. FT., OR 4 SQ. FT. PER PERSON. ALL PARTIES, EXCEPT M, N AND SPECIAL GROUP, WILL BE IN FOURS
PENS FOR EACH GROUP SHOWN
barrier
blind passage
Avenue Marshal French
+ Aid Station
Menin Gate Café
press ambulance etc.
private house
T H K J C Q R
public
barrier
NORTH APPROACH
P
G
A
M
N
F
E
S
L
SOUTH APPROACH
Special Group
MOAT
CAUSEWAY
MOAT
MENIN GATE MEMORIAL
Special group chair park
party chair park
North Ramparts
South Ramparts
D B I O
Stairs to ramparts
Stairs to ramparts
entrance
Rue de Corbeau
CORNER X 2.
entrance
Rue de la Boule

on a perfect summer day. What impressed me most was the quiet and solemnity of the great crowd spread over this sacred ground where so much fighting had taken place.

At Beaucourt also an aid post was located in a hut near the station, one at Thiepval, and one at Newfoundland Park in a hut in the centre of the park, which contains the wonderful memorials to the Newfoundland troops and the 51st Division.

Only minor cases had to be treated. The posts at Thiepval and Newfoundland Park were in telephonic communication with the post at the railway station.

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Pilgrims concentrating at the Menin Gate for the Service on August 8, 1928.

On August 8 both medical units left Arras early in the morning and arrived in Ypres at 9 o'clock, in order to prepare their aid posts before the pilgrims concentrated at the Menin Gate for the Commemoration Service at 11.30 a.m. Two aid posts were established, one for the Service at the Menin Gate, the other in the square in the remains of the Cloth Hall, for the march past. A room in a café made an excellent aid post at the Menin Gate, shown thus + in the plan. Orderlies were posted amongst the pilgrims in the different enclosures to render first aid. The ramparts on the east of the gate were reserved for elderly men and women, cripples and

those unable to stand the strain of a long wait. One V.A.D. nurse and one B.R.C. orderly with a small amount of equipment were detailed to look after them.

The concentration of these 11,000 pilgrims at the Menin Gate took place without a hitch, and all were in position before the time arranged for this memorable Service to start. After the Service, the march past the Prince of Wales was equally well carried out. Several hours were then allowed to the pilgrims in Ypres before entraining for England, which started about 4.30 in the afternoon. The only medical assistance required in Ypres was during the Service for faints and hysteria. The number of these cases was small considering the number of women present and the emotional strain.

The Service at the Menin Gate was very impressive and was joined in with deep feeling by all this great crowd, who had come together to honour the memory of their dead in the land where they had fallen.

Editorial.

VACCINATION.

THE Ministry of Health has just issued the Report of the Committee on : (1) Matters relating to the preparation, testing, and standardization of vaccine lymph ; (2) the practical methods which are available in the light of modern knowledge to diminish or remove any risks which may result from vaccination; (3) the methods of vaccination which are most appropriate to give protection against any risk of small-pox infection in epidemic and non-epidemic periods.

The report is divided into two parts. Part I deals with each reference in turn, but from reference (2) the consideration of the nervous symptoms is excluded. Part II is devoted entirely to this subject.

Dealing with the first reference the committee state that vaccine lymph is obtained from susceptible animals which have been inoculated with "seed" lymph. Seed lymph may be obtained from: (*a*) Small-pox direct, after passage through calf or rabbit or both. (*b*) Cow-pox, material from the vesicles on the teats and udders of cows naturally infected with cow-pox, such strains generally degenerate rapidly when passed from calf to calf. (*c*) Horse-pox, sheep-pox, goat-pox, fowl-pox, swine-pox. It is claimed that horse-pox and sheep-pox have yielded a virus indistinguishable from that of vaccinia, but there is not any record that strains from these sources are in use at the present time. (*d*) Vaccinia in the human being, or retro-vaccination. Human lymph can be employed to raise a new strain of seed lymph by inoculation of animals. This method is still used abroad, but not in this country.

In Vienna it is claimed that Jenner's lymph has been carried on from arm to arm ever since his samples were received over a hundred years ago.

Repeated transference from calf to calf tends to cause deterioration in vaccine lymph, but if seed lymph of fair quality is inoculated cutaneously on the rabbit improvement is noticed in the quality of the strain when subsequently used for calf vaccination. By periodical passage in this way the quality of the seed lymph may be maintained for many years. A regular sequence of animals may be employed as in the United States (human being, rabbit, calf) and in Java (human being, rabbit, calf, buffalo).

Drs. Blaxall and Ledingham have tested Carrel and Rivers' method of cultivating the virus *in vitro* in contact with chicken embryo, and have demonstrated in a seed lymph of low potency an increase in potency of 1,000 fold. The committee state that if these findings are substantiated it may be possible to dispense with the current method of making lymph on

the large scale. This lymph would have the advantage of being free from extraneous organisms

The amount and dilution of the vaccine lymph issued for a single dose varies. The most common practice is to dilute four times (1 in 5), and issue for a single dose $\frac{1}{25}$ to $\frac{1}{50}$ cubic centimetre.

The minimal dose of vaccine sufficient to give in the human subject characteristic vesicles and immunity lasting for a reasonable time has not been determined. In rabbits a dilution of 1 in 100,000, or even 1 in 500,000, may give successful results.

The technique and procedure in the Government laboratory are described, and when by the action of glycerine the organisms in the lymph are eliminated or reduced to five or less per milligram the lymph is ready for issue and $\frac{1}{50}$ cubic centimetre, the amount regarded as sufficient for one vaccination, is placed in each tube.

In October, 1925, international co-operation with the Office International d'Hygiène Publique and the Health Organization of the League of Nations was secured for an intensive study of the practice of vaccination and the complications, especially nervous manifestations, which have followed vaccination. A Small-pox and Vaccination Commission was appointed, and met at The Hague in January, 1926. The investigations relating to the conditions of production, purity and potency of vaccine lymph were completed in January, 1927, and the findings were considered by the Vaccination Committee and the Ministry of Health in framing regulations under the Therapeutic Substances Act which came into force on August 6, 1927. These regulations detail tests for purity and tests for potency. The tests for purity declare that if living, gas-producing, anærobic organisms, or streptococci are present, the batch of lymph shall not be issued. Quantitative determinations of the number of bacteria and other viable micro-organisms must be carried out, and these must be reduced by the action of glycerine or other disinfectant to not more than 5,000 in 1 cubic centimetre of vaccine lymph.

In the test for potency the lymph is diluted with 1,000 volumes of physiological salt solution and, applied by an approved method to the prepared skin of a rabbit or guinea-pig, must produce the characteristic lesions of vaccinia virus. Four experimental methods for testing the virulence of vaccine lymph were suggested for trial, viz.: (1) Gin's inoculation of the scarified cornea of a guinea-pig; (2) Sobernheim's inoculation of four shaved and depilated patches on the skin of a rabbit; (3) Groth's injection intradermally into the depilated or shaved skin of a rabbit; (4) Calmette-Guerin's inoculation of the shaved backs of rabbits with dilutions varying from 1 in 100 to 1 in 1,000. The committee decided that all four methods were suitable, but the lymph must be ground up into a state of fine division and not filtered.

In connexion with the terms of the second reference the committee give a brief review of the work of the Royal Commission, 1889-96, and also

a summary of the recommendations made, most of which were embodied in the Vaccination Act of 1898, which became operative on January 1, 1899, and is still in force. The Vaccination Order of 1898 followed the Act of 1898, and contains the instructions to public vaccinators.

A comparison of alleged ill effects of vaccination before and after the Vaccination Act has been made, and the committee find that after the introduction of the Act and Order of 1898 there has been a reduction of approximately one half in the number of deaths coded to vaccinia. In 1897, a pronounced and sudden diminution occurred. During the period 1886-91, there were 4,290,000 infants vaccinated and 279 deaths at all ages. During 1911-25 there were 5,500,000 infants vaccinated and 128 deaths. The committee consider that the reduction is largely due to the recommendations of the Royal Commission directed to the prevention of sepsis. The outstanding differences between the two periods are the disappearance of syphilis as a cause of death and the appearance of diseases of the central nervous system, other than convulsions. The disappearance of syphilis was forecasted by the Royal Commission when they recommended the use of calf lymph. Convulsions are occasionally met with in the course of vaccination, as in other febrile diseases, but it was not until 1923 that certain other manifestations appeared. In that year mention of terms suggesting an affection of the central nervous system appeared on the certificates relating to six out of a total of nine deaths coded to vaccinia. About the same time that these cases occurred three similar fatal cases were reported in Bohemia. A possible relation between acute diseases of the central nervous system and vaccination was first noticed by Turnbull in 1922, in connexion with four fatal cases of polio-encephalo-myelitis admitted to the London Hospital. Seven similar cases were found on inquiry at other hospitals. The medical officers of the Ministry of Health then investigated the matter, and by the end of 1923 information as to fifty-one other cases was received. These events led up to the appointment of a committee under Sir Frederick Andrewes to consider whether any further experimental research could be instituted to throw light on the possibilities of vaccine lymph producing brain or other nervous diseases as a complication of vaccinia.

At the instigation of the late Dr. J. Brownlee an inquiry into the subsequent medical history of vaccinated persons was made by Dr. P. Kinloch, who concluded that vaccinia had no prejudicial effect on a child's future well-being as judged by its reponse to subsequent infection.

The vaccination committee instituted similar inquiries and found that the diseases which occurred were those ordinarily met with in infants whether vaccinated or not. Neither in the vaccinated children nor in the non-vaccinated controls did diseases of the nervous system appear.

The Andrewes Committee thought that as regards the relation between cases of encephalitis and vaccination, there were three possibilities: (*a*) That the cases of encephalitis were genuine sequelæ of vaccination and due solely

to the virus of vaccinia; (*b*) that the cases though coincident with vaccination were due to some different and independent cause; (*c*) that the cases were due to the combined action of two morbid viruses, viz., vaccinia, and some other familiar or unfamiliar virus. After considering all the facts relating to sixty-two post-vaccinal cases of acute nervous disease and forty-seven others, which from the clinical point of view were possibly of the same nature, the Andrewes Committee say, "It appears to be extremely improbable that the cases can have been due solely to the vaccinia virus and the majority attach no credence to this hypothesis." . . . "It is not altogether improbable that vaccination may here and there have precipitated an encephalitis in a person harbouring another virus." They think there would appear to have been something more than the mere overlapping in time of vaccination with some familiar or unfamiliar neurotropic virus, and the unusual clinical and histological manifestations and lethal character of the best studied cases suggest that a combination of viruses of the kind indicated was operating.

The committee on vaccination commenting on the report of the Andrewes Committee agree that on present evidence the association of encephalitis with vaccination is not fortuitous and that vaccinia cannot be held solely responsible for the nervous sequelæ. They think that owing to lack of data it is extremely difficult to evaluate the hypothesis of combined virus action. In the present uncertainty with regard to the ætiology of encephalitis lethargica and of the cerebral manifestations of poliomyelitis virus they believe it would be inadvisable to exclude these conditions from playing a possible rôle in conjunction with vaccinia. Only further experimental research can throw light on this problem.

Dutch observers consider that encephalitis lethargica does not play a possible rôle in conjunction with vaccinia, but suggest that both in Holland and in this country some unknown and otherwise innocuous virus may be harboured by individuals, particularly in country districts, which has the property of being activated by vaccinia and possibly also by the virus of measles and whooping-cough.

From the experimental data obtained for the committee on vaccination there emerges the one positive fact that the virus of vaccinia can be demonstrated in some of the brains from cases of post-vaccinal disease of the central nervous system. The finding of vaccinia virus in the brains of fatal cases is, however, considered to be of minor importance in view of its unequivocal demonstration in the brains of animals after ordinary cutaneous vaccination with calf lymph. No definite results have been obtained from experiments designed to demonstrate the presence of another neurotropic virus. But as equally non-conclusive results have followed the attempts to transmit the presumed virus of encephalitis lethargica to animals, the experiments cannot be said to disprove the possibility of the lethargica virus playing a part in post-vaccinal encephalitis.

Professors Turnbull and McIntosh claim that post-vaccinal encephalitis

is from a histological point of view sharply differentiated from encephalitis lethargica and from poliomyelitis. They say that in the white substance of the brain and of the spinal cord there occur around certain vessels "broad zones of softening." Dr. Perdrau examined five fatal cases of post-vaccinal encephalitis and found the characteristic lesion to consist of a "peri-vascular zone of *demyelination* around the vast majority of these vessels which may show in other respects evidence of an inflammatory process. The affected vessels are principally those of the white matter of both the brain and the spinal cord." He believes this lesion to be identical with the peri-vascular softening described by Turnbull and McIntosh, and considers their claim to be fully borne out. He also thinks that the lesions in small-pox and nervous complications of measles as well as those of anti-rabic inoculations are of the same type histologically. He states that the available evidence indicates that from a histological point of view the nervous sequelæ of the acute infective diseases (measles, chicken-pox, typhoid fever, etc.), form a fairly homogeneous group which includes post-vaccinal encephalo-myelitis.

Dealing with the third term of reference, viz., the methods of vaccination which are most appropriate to give protection against risk of small-pox infection, the committee first discuss methods of vaccination. Dr. Edward Seaton in 1867 recommended parallel scratches, crossed or not, for arm to arm vaccination. With the advent of calf lymph, Dr. Cory employed an oblique incision with a sterilized blunt lancet into the skin, as deep as the middle layer of the rete Malpighii. In 1917 the German Federal Council decreed four shallow cuts at most one centimetre long. Cross hatching or scarification was forbidden. In New York, regulations prescribe a multiple puncture method consisting of six to ten very superficial punctures with a sterile round needle within an area of one-fourth of an inch. Cross hatching is prohibited, though a single scratch not more than half an inch long may be made if preferred.

In this country no special method of vaccinating is prescribed or advocated. The vaccinator must aim at producing four separate good-sized vesicles and the total area of vesiculation must be half a square inch. The vesicular area prescribed is based on the observations of Marson, Gayton and Barry. Dr. Cameron submitted statistics to the vaccination committee which indicated that protection against death is directly related to the number of scars and the area of cicatrix. In a given area of cicatrix protection is greater when there are four divisions than when there are only three or two. Dr. Major Greenwood's analysis of Dr. Cameron's figures supported his contentions.

Studying the reaction of immunity, the committee point out that while the evidence placed before the Royal Commission was based mainly on the vaccinal condition of persons dying from small-pox, there exists now another criterion in the immunity reaction of von Pirquet, although it is necessary to differentiate between immunity to small-pox and immunity to

vaccinia. Cory foreshadowed von Pirquet's work. He showed that if he vaccinated a child by one insertion on successive days up to the ninth day from the date of the first inoculation, all the vesicles matured at the same time, viz., on the ninth day after the first inoculation. Cory expressed his belief that the date of the appearance of the areola in revaccination is a sure index of the regression towards susceptibility to small-pox, and the earlier the areola the greater the immunity present. The committee state that the interval between inoculation and the maximum reaction in a secondary vaccination indicates the measure of immunity to vaccinia. The shorter the interval the greater the probable immunity.

The committee then refer to the experiments carried out at Woolwich in men 18 to 21 years of age, and state that the effect of primary vaccination is to accelerate the average day of maximum reaction to revaccination by at least three days, which period represents the amount of immunity remaining from primary vaccination.

Vaccination practice in England has aimed at securing in infancy as long a duration of immunity as possible, and to postpone the time when revaccination is necessary, whereas American-Canadian practice is to render vaccination as little incommoding as possible in the hope that a second, or even a third, vaccination will be sought.

The committee state that no evidence has been given that any better method than that given in the "Instructions to Vaccinators" can be employed to secure at one operation protection against small-pox for the longest possible period. If, however, immunity of a population is to be maintained at a satisfactory level, revaccination must be carried out from time to time.

The type of small-pox prevailing in this country for the past five years has been benign, with an almost negligible mortality. At times there have been small outbreaks of a more severe character, usually traced to an infection from abroad, and the danger of such infection is always present. During such outbreaks vaccination is accepted without much protest. But it is alleged that the disabilities resulting from vaccination in an unvaccinated adult are greater than those of an attack of benign small-pox, and the fact that this is the prevailing type at present, combined with the absence of fatal cases, has deterred many persons from accepting the protection of vaccination.

In these circumstances the committee have endeavoured to find out what relaxation of ordinary procedure might be allowed so as to popularize vaccination and yet secure a satisfactory immunity. They state that, given a potent lymph, 100 per cent insertion success can be obtained by a single linear incision not more than six to seven millimetres (quarter of an inch) long, merely through the epidermis, and by the simple application of lymph thereto. They accordingly recommend that in place of four insertions trial be made of vaccination and revaccination in one insertion, with a minimum of trauma, and that multiple scarification and cross hatching

be deprecated. Vaccination should be performed between two and six months as at present, when the possibility of nervous complications seems to be least pronounced, and revaccination offered at 5 to 7 years, and again at 14 to 16 years. Vaccination by multiple insertions should be available for those who wish to have the maximum protection obtainable from one operation. Instead of the one inspection now required in the case of public vaccination, there should be two—the first not earlier than the seventh day or later than the tenth day, and the second not earlier than the fourteenth day or later than the seventeeth day.

The committee have done all they can to popularize vaccination, and are able to state categorically that vaccination and revaccination will prevent small-pox.

Clinical and other Notes.

NOTES ON A CASE OF PLAGUE IN ADEN.

By Major R. HEMPHILL, D.S.O.
Royal Army Medical Corps.

In connexion with a serious outbreak of plague in Aden, which began in January and continued until May, 1928, resulting in a total of 1,494 recorded cases with 1,107 deaths, among the native population, it may be of interest to record the only case that occurred in the British Garrison, the whole of which was protected by inoculation with Haffkine's anti-plague vaccine, shortly after the commencement of the epidemic.

Pte. S., aged 24, of the 2nd Battalion the South Wales Borderers, was admitted to the British Military Hospital from the Crater Barracks on April 10, 1928, after having been taken suddenly ill with a shivering attack. He stated he felt out of sorts two days previously and had a dull headache and pain in the left groin. There was no previous history of illness or injury. He was inoculated against plague early in February.

On admission, his temperature was 105° F. and his pulse 120. He was prostrated, dull, and listless, his face had a muddy flushed appearance, the conjunctivæ were suffused, and he looked drawn and anxious. His tongue was covered with a thick brown fur. The left femoral glands were enlarged, tender, and inflamed. Nothing else could be discovered on general examination, though he complained of a pain in the right chest. He was delirious on and off for the first three days.

On the third day of his illness he developed a small pneumonic patch at the base of the right lung. From the first the case presented the clinical appearance of bubonic plague; the patient was admitted direct to the Isolation Block of the British Military Hospital, and the usual sanitary precautions as regards segregation of contacts, etc., were enforced. His condition during the first five days of his illness was extremely critical. General symptomatic treatment was ordered, together with appropriate local applications to the bubo. On the fifth day it was considered that an intravenous injection of twenty cubic centimetres of a one per cent solution of mercurochrome might be beneficial. The amelioration of his symptoms coincided with the administration, for his temperature dropped from 104° F. to normal and his pulse from 92 to 70; the patient looked and stated he felt much better. In twenty-four hours his temperature rose again to 102° F., the intravenous injection was repeated, and was again followed by a drop to normal, where it remained, and the patient rapidly became convalescent.

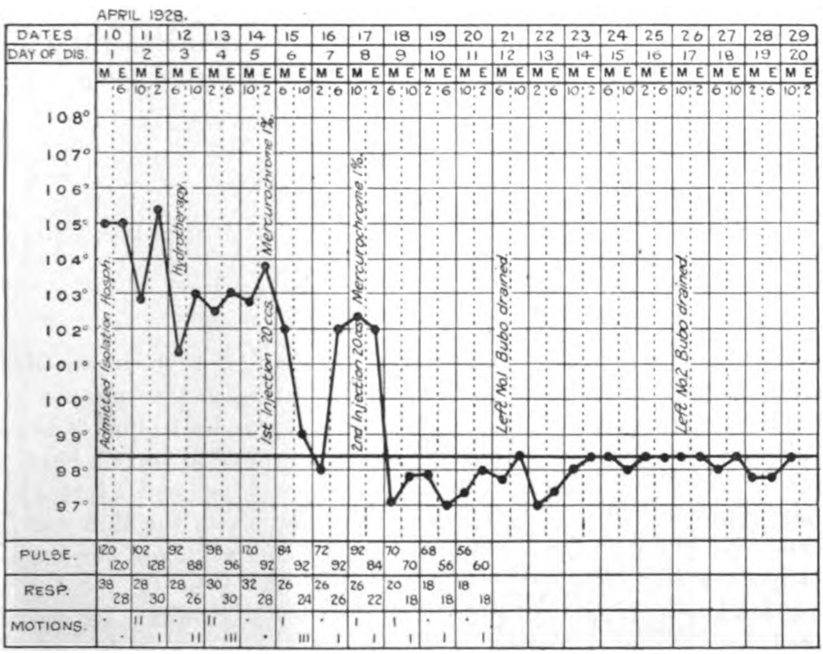
On the twelfth day the first bubo was opened and drained. On the

seventeenth day a second bubo, also in the left groin, was likewise drained. They both healed rapidly, and the patient made an uneventful recovery.

Diagnosis and Bacteriological Investigations.

Though the case from the beginning was clinically typical of bubonic plague, no bacteriological confirmation was forthcoming until the buboes suppurated.

A guinea-pig, inoculated with pus cutaneously, remained healthy. Another guinea-pig, inoculated subcutaneously with pus, died four days later. The post-mortem appearance of this guinea-pig was typical of plague infection. The heart's blood, spleen and liver were heavily infected with bacilli, having the morphological characteristics of *B. pestis*.



The pus inoculated into agar tubes produced a pure culture of plague-like bacilli, which, when inoculated into a guinea-pig subcutaneously, caused death on the third day; post-mortem appearances of the guinea-pig were typical of plague infection, and bacilli having the morphological appearances and staining reactions of *B. pestis* were found in very great numbers in smears of the spleen, liver, and heart's blood.

Another guinea-pig, inoculated cutaneously from the culture, died on the fifth day, and post-mortem findings in this animal were also typical of *B. pestis* infection. Subcultures sent to the Central Research Institute,

Kasauli, for verification were reported on as showing typical morphological, cultural, and biochemical characters of *B. pestis*. It is, perhaps, of interest to note that the British and Indian troops, all of whom were fully protected by inoculation, were living in or alongside an area that was heavily infected with both human and rat plague. A few fatal cases occurred amongst the native followers living within or employed in the British Infantry lines, and latterly plague-infected rats have also been detected in the British Infantry lines at the Crater.

The plague epidemic is now at an end; it is fortunate that only one case amongst the British troops has to be recorded.

I wish to express my thanks to Colonel A. E. Hamerton, C.M.G., D.S.O., for his permission to publish the case and for his invaluable advice and assistance with reference to the bacteriological investigation, also to Captain Karandikar, Indian Medical Service, and Doctor Chitre, for their keenness and help in carrying out the same, and to Lieutenant-Colonel E. Phipson, D.S.O., I.M.S., for his suggesting the use of and supplying me with mercurochrome.

A CASE OF TRAUMATIC MYOSITIS OSSIFICANS.

By Major C. W. BOWLE.

Royal Army Medical Corps.

Bandsman B., aged 21, was admitted on May 12, 1928, to the Military Hospital, Malta, complaining of a large hard mass in the muscles of the inner side of the left thigh, which caused limping and a feeling of tiredness after playing games. On examination he was found to have a hard, bony tumour of very considerable size, irregular in shape, and of stony consistence, lying in the deep thigh muscles, over which the skin was freely movable. No glands were involved; there was no œdema of the limb.

He gave a history of a blow by an opponent's knee on the leg when playing football in January, 1928, which caused a swelling, for which he attended hospital for a period of about three weeks, and for which he received massage. He subsequently returned to duty.

About the first week in April, 1928, he noticed some bruising coming out. He reported sick, and was ordered rest with "bed down" for a week. He then again resumed duty, and carried on until he noticed that a hard lump was developing in the affected part, but he continued to play cricket up to time of admission.

Antero-posterior and lateral radiograms were taken which accompany these notes; it will be noticed that the tumour was of large size, and that there is a solution in continuity between the tumour and the periosteum of the femur just above the point of origin.

An operation was performed for the removal of this bony mass on June 25, 1928.

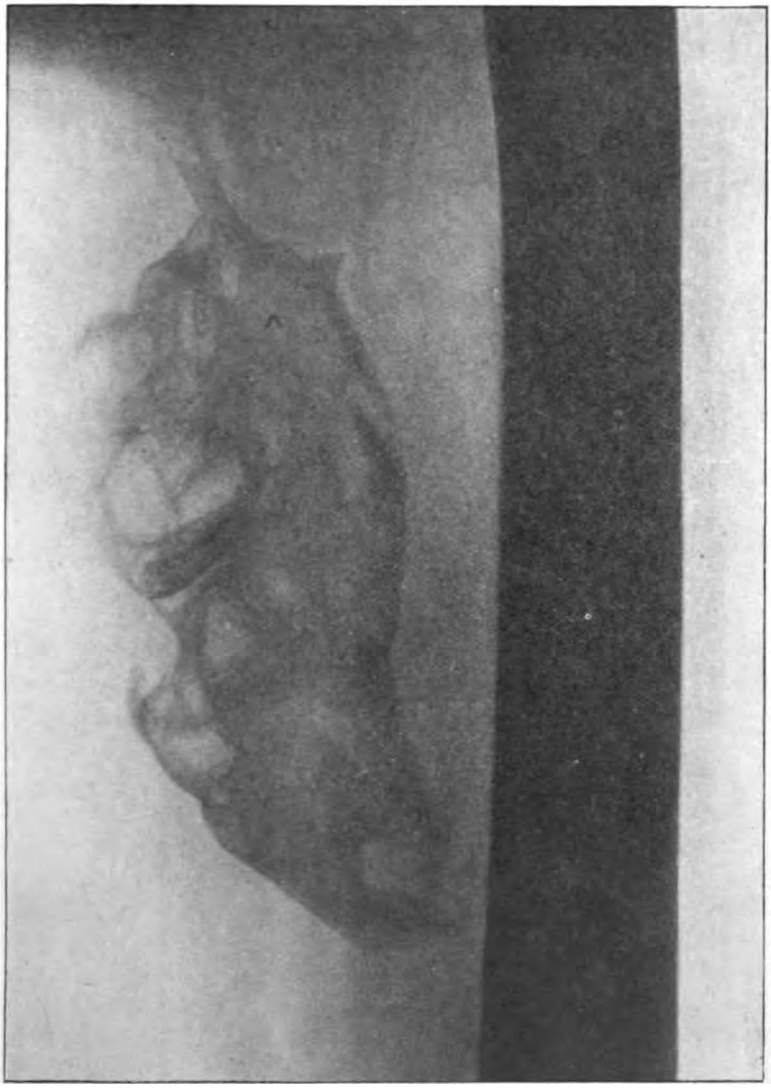


FIG. 1.—Antero-posterior view of bony tumour, left femur.

An incision, eight inches long, was made over the most prominent part of the tumour parallel to the long axis of the limb, and a large, bony, irregular mass found lying in the adductor muscles. The tumour was removed by excision and enucleation, and the bony growth emanating from

the shaft of the femur chiselled away flush with the natural contour of the bone.

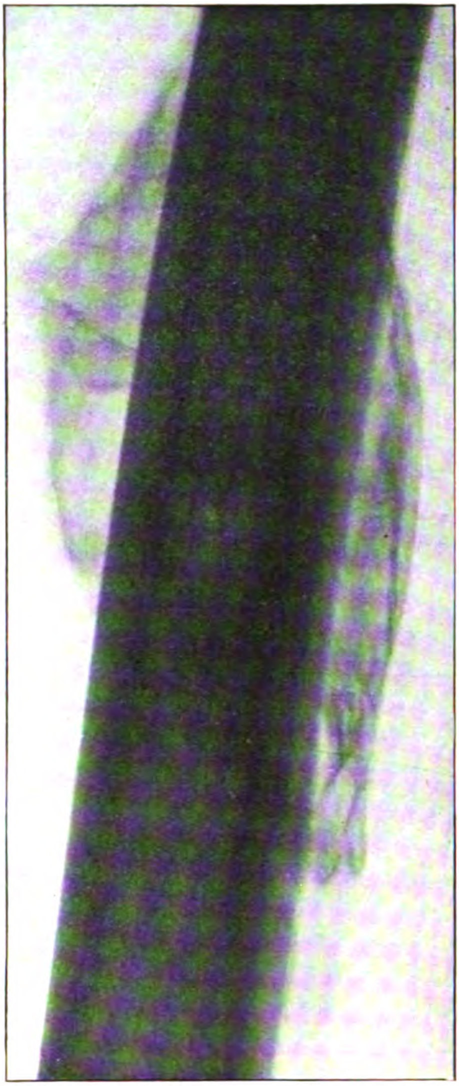


FIG. 2.—Lateral view of bony tumour in relation to shaft of femur.

The femoral artery and vein were carefully retracted during the operation, and the divided muscles were brought together as well as the removal of so large a mass made possible and the part firmly bandaged.

Subsequent radiograms showed that the tumour was completely removed. (Size, fifteen centimetres long; seven centimetres wide.)

Fig. 3.—Tumour after removal.

The case has done well, and there is no resultant disability. The size of the tumour is readily observable from the accompanying radiograms.

A large percentage of cases of this nature occur in the brachialis

anticus after injury of the elbow joint, and on these I have frequently operated; but I believe their presence in the adductors to be more rarely

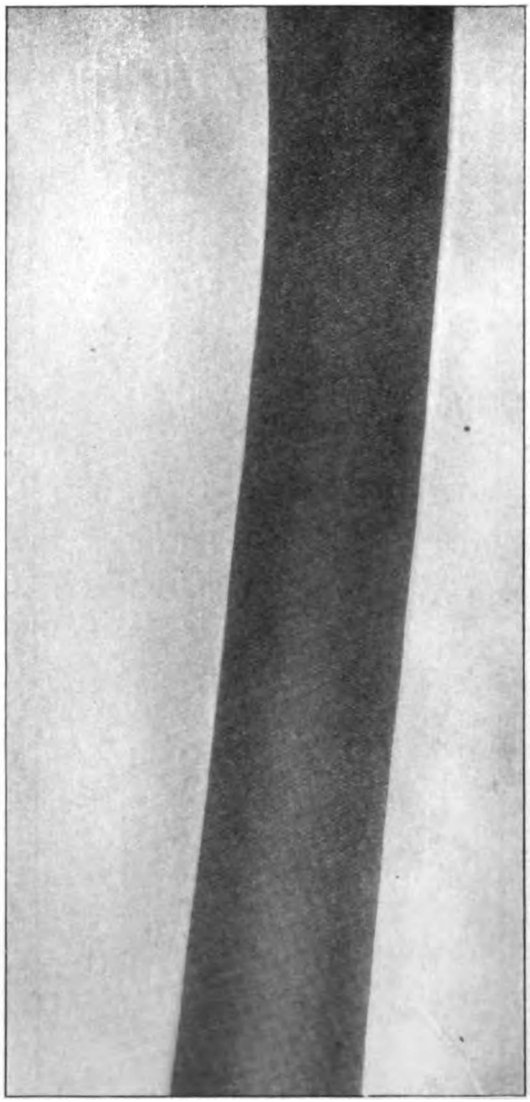


Fig. 4.—Shaft of femur after operation.

found, although cases occur in the extensor muscles of the thigh; further, the case must be differentiated from "riders' bone," myositis ossificans, as opposed to the variety known as "traumatic myositis ossificans."

A report from the Deputy Assistant Director of Pathology, Major F. Casement, D.S.O., showed that the tumour had the usual characteristics of a growth of this nature.

I am indebted to Corporal J. F. Barnard, R.A.M.C., for his excellent radiograms which accompany the notes on this case.

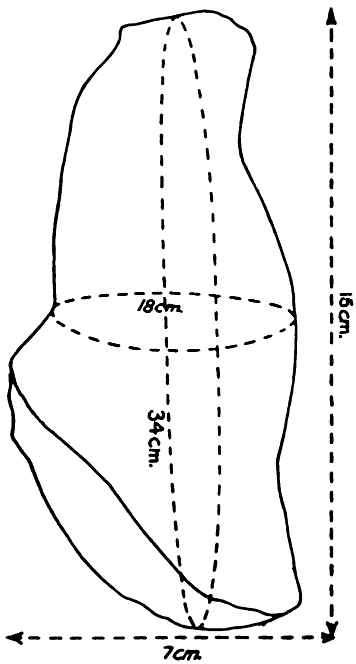


Fig. 5.

Sport.

THE RED BEAR OF KASHMIR.

By Lieutenant-Colonel R. H. L. CORDNER.
Royal Army Medical Corps.

During the month of April, all over India, our thoughts turn to the leave season, and plans are made on all sides how best to spend the sixty days or, if one is very lucky, ninety days' leave. A few plan trips home; others turn their thoughts to the social centres—Simla, Murree, or Mussoorie, there to continue the round of tennis and dancing they have so often stated bored them to tears. Perhaps in many such cases it is the hand of the memsahib driving!

I planned a circular trip, extending over two and a half months, in

searching for red bear. I am told that these bear used to be found quite close down in the Kashmir Valley, but yearly are withdrawing further and further back into the mountains, and are now seldom seen until many marches have been made into their lonely haunts.

My idea was to start from Srinagar and march over the Zogihar Pass, through Dras, and branch off and explore the Shiga-Shunga Valley and the Lesser Deosi Plateau. Here, my shikari had informed me, red bear and ibex were as plentiful as mulberries in the plains. Arriving at Srinagar, a few days were spent in collecting supplies and stores, examining tents, and buying odds and ends. The shikari went forward to collect porters at the mouth of the Wangat Nullah, where I would meet him coming by boat with the stores, and so save a couple of marches. Everything turned out according to plan, and on arrival I found a weird collection of Balti porters muffled up in their bundle of old bed-clothes and skins, tied together with bits of rope and string. In spite of the mass of clothes they wear they appear to suffer no discomfort either in the hea of the Kashmir Plains or in the cold of the snow-covered passes. The loads they can carry are wonderful, but there is an official limit when working for the sahib.

This is often disregarded, and an extra few annas at the end of the journey seem amply to repay the bearer. The loads are laid out and the shikari and I pick the bearers. The line is now ordered to load up. At once a general wail goes up from every throat. They all call on the sahib and heaven to witness that their load is at least three times the maximum weight! A little chaff, and a few words of surprise that a man as big as an elephant should complain about such a small load, restore order and good humour, and the loads are lifted, roped on, and away the line trudges, each man bent double and supporting himself heavily on his stick to show the sahib how overweighted he is. In reality the load is about a third of what the same man will carry when doing contract work. The sahib, shikari with rifle and camera, and tiffin coolie, go in front. The bearer brings up the rear to see that nothing is left, and away we file by the banks of the river.

Along the route there are recognized camping grounds. On the more frequented roads dāk bungalows are established, where a khansamah will provide food and refreshments. The more distant ones are less elaborate and only provide shelter, the traveller bringing all his own supplies. Further on, the camp is merely a piece of ground recognized by custom as the end of the march. It is just as well to avoid this and camp either a little before arriving at it or a short distance beyond. You have the advantage of getting on clean ground. For some reason the porters hate this arrangement. They are creatures of custom. A few marches more and we camp where and as we will, and are able to find suitable ground. We have passed the limits of camping grounds.

Day by day, on we march, the track becomes steeper and rougher, and one day the first snow is reached. It is curious with what pleasure one

always regards this first patch of snow. You invariably walk in it, prod it with your khud-stick, and feel that you are at last getting on.

Later on, when wading knee-deep through it, helping to make a way for the loaded porters, somehow one begins to regard it in a different light. We arrived eventually at Dras, and put up for a day or so at the dâk bungalow. This is the last bungalow to be seen for some time, as the way is now off the beaten track and enters the shooting grounds. Here porters are changed. The old lot are lined up, and I pass down the line handing to each from a bag his exact pay. This completed, I stand aside. There is a look of deep depression on all. I start again and put another two or three annas in each palm. The whole line break into loud thanks for my generosity! It amounts to less than a farthing a day! The next batch of porters will take me on as far as Coxa, and here a fresh lot must be obtained to accompany me to the Deosi, where I hope to camp and shoot in real earnest.

The march is along the river most of the way, and it is always worth remembering that where there is water there are always fish, and fish greatly add to one's camp supply. Always take a rod and a few hooks. The bait may be "atta" or, better still, "keera." Look out for a marshy bit of land near the river. Turn over a few stones, under each will be a little tube of sticks and sand, and in each tube a caddis fly grub. A couple of these on a hook and you are assured of a fish for dinner. Always carry a rod wherever you go. You will never regret it. It is always amusing to see the blank astonishment of the local inhabitants at your success; they examine the rod with interest. The fine line always excites their admiration. They are always anxious to copy your methods, but to do so requires similar tackle. Yours is the only supply in the district, so, watch it carefully. The native often considers the result justifies the means.

We had to remain a couple of days at this large village by Coxa to collect coolies, some of whom came from a distance. I purchased also a small stock of flour. These villages have only a small surplus margin of supplies, and they are not as a rule eager to sell. In the winter there can be little between them and starvation, should they under-estimate their consumption.

Towards the afternoon the shikari spotted some ibex on the mountains above us, and the villagers said they were always there, and remained during the night on the hillside. There were two quite nice heads, so we decided to do a stalk. The wind was blowing down towards the foot-hills, but would probably change later on. The dry bed of the nullah was selected; we intended to go up this until near to the herd, and to start the stalk according to the wind. The climb became steeper and steeper, until in the end it was a scramble up almost sheer rock. The shikari went in front, got a foothold, and then threw his puggari end to me. With the aid of this I would scramble up beside him. The village lay below. As one climbed up it seemed to become smaller and smaller, with the people

like little ants. I could not help thinking in what a nasty mess one would arrive down there if one's foot slipped.

After a long climb we at last arrived at the group of rocks beyond which the herd of ibex had been located. The shikari removed his puggari and cautiously peeped over. He glanced round, turned and shook his head. The game was up! I stood up, gazed at the vacant nullah, and vowed I would never stalk another ibex though the shikari assured me they had horns trailing on the ground behind them. This resolution was kept until, aligning my glasses along the shikari's pointing finger, once more a pair of those glorious curved horns came into focus. Then a similar climb, a similar result, and an identical resolution! The way of the ibex hunter is very hard. Our porters collected and all arrangements complete, we continued our march up the nullah. The shikaris ranged far and wide on the flank, looking out for signs of bear and ibex, although I gave them to understand that my enthusiasm for the latter was at zero.

One afternoon, while sitting out on the watch after getting into the camp, the shikari suddenly pointed, and getting out the glasses I saw a magnificent bear grubbing along on the opposite side of the river, and about a mile away. The game had been located, but between us rolled a snow-fed river. A council of war was held. The locals suggested crossing at a ford about a day's march ahead. The river was high, and they were doubtful about the possibility. The alternative was to go back four marches and cross by a rope bridge. About the latter the men were not enthusiastic. No one had crossed that year, and the bridge would not be in the best of repair after the winter storms. We decided on the former course, and set off early next morning. On arrival three men joining hands attempted the ford, and after a struggle got across. They came back shivering and breathless, and said the ford could only be attempted by unloaded coolies, and not at all by the sahib. On this point I had quite made up my mind, so our agreement was mutual.

The alternative must now be tried, viz., a march back to the rope bridge and a return march up the other side. It was necessary, too, to act quickly, as somehow in that mysterious native way the coolies had heard that there was a sahib encamped at the mouth of the nullah. If he first crossed the bridge, the nullah and the bear would be his. Four of the best coolies were picked, the lightest of kit packed, and a bivouac tent and two blankets for myself and a blanket for each coolie. "Atta" for the men and four tins of Maconochie rations, jam, biscuits, tea and sugar for myself. All was soon prepared, and we started on our long march to the bridge and back to where we had seen the bear.

It must be remembered that a day's march in the mountains simply means the distance a heavily-loaded man can go in a day. The actual mileage is of little account. The difficulty of the march is the chief consideration. Shortly after starting the porters spotted some ponies—half wild animals, grazing on the hillside. This suggested riding. I quite

agreed. A stalk was started, and soon six ponies were captured. The men settled themselves and their packs on their mounts. Three in the front, myself, then the shikari and a coolie behind. I had expected a quiet walk along the tiny track on the hillside. Not so the coolies. A few yells, the ponies were banged with khud-sticks, and away we went at a fast trot, and sometimes at a gallop. Round corners, down into snow-filled hollows, and across shingle slopes. A slip would have sent the man and pony down hundreds of feet into the river below. Anyone wishing to practise this sort of ride should borrow a horse, get it on the roof of a house and trot round the gutter. Although dangerous, the pace was certainly faster than one could possibly have made on foot. A pause was made for refreshments and breath. The coolies proceeded to smoke. One man went round and collected a donation of tobacco from each. A piece of ground was selected, and he thrust his thumb into the earth up to the joint. A strong stem of grass was then pushed into the earth in a downward direction for a distance of six or seven inches to meet the tip of the buried thumb. The pipe was complete. The bowl was filled with the contributions of tobacco, lighted, and each man, kneeling down, placed the corner of his puggari over the "mouth-piece" and drew a few whiffs. He then retired to gasp and cough while another took his place. The pipe having been finished, the ride was resumed.

Towards evening the men paused. We were now near a little village, and they thought it would save unnecessary discussion with the villagers if we arrived on foot and not on horseback.

We dismounted. A few bangs with the ever-useful khud-stick and a few well-aimed stones rewarded our mounts and directed them back along the path we had come. It was getting quite dark when we arrived at the bridge. A scout returning informed us that the sahib was camped at the bridge itself. We decided to lie up for a few hours until the camp was asleep, and then slip across.

We hid ourselves away amongst the rocks in the nullah, and tried to get as much rest as possible. It would not do to light a fire, so I had a couple of biscuits and a drink from the stream and tried to sleep. At earliest daybreak the shikari roused us, and we silently filed past the camp and arrived at the bridge in the dim light. Horribly frail and tattered it looked, hanging loosely across the torrent.

A Kashmir rope bridge consists of three ropes made from twisted willow twigs and grass. One is the foot-rope, and the other two are hand-rails. The latter are connected at intervals to the foot rope by sticks, which help to steady the whole structure. Many of these side supports had fallen away, and the whole thing looked as if it would fall to bits at any moment. I most earnestly wished it had done so long ago. Still there was no help for it. The lightest coolie was already on the way. He crossed in safety, and I followed. The shikari warned me to walk lightly and with the greatest care; the advice was quite unnecessary, a cat could not have

walked more lightly. At one point one of the sticks slid out of the rope and vanished into the stream forty or fifty feet below. It gave me a nasty feeling inside. At last it was over and I stood on the other side. One by one the others crossed and the party was reunited.

The shikari came and told me the bridge was in a very bad condition, and if the other sahib tried to cross it might only result in a regrettable accident. I agreed. A few blows with the little axe carried by every Kashmiri and our end of the bridge slid down the bank, rapidly uncoiled, and vanished in a welter of grass and sticks.

Again the march started, and about 10 or 11 a.m., feeling dead beat, I arrived in the nullah in which we had seen the bear.

My tent was up in a couple of minutes, and in a few more we were all fast asleep. In the afternoon the shikari went off to find traces of the bear. He found recent signs, and said he had been there the day before at least. Next morning we ranged round, and at last spotted him on the hillside, and coming towards us. We rapidly approached each other under cover of a hillock. I had only to climb the hillock and meet him face to face. The moment arrived, and I peeped over the top; a treacherous puff of wind had given the show away, and the bear was in rapid retreat and already three hundred yards away. I took a couple of shots and saw the snow spurt up close to his side. That finished it. He was off at a pace which was something to wonder at.

On the following morning we started up our side of the river, and later met the remainder of the party. We marched up, each on our side of the river. About two further marches up it was decided that a crossing was possible. Early morning was chosen for the attempt, as these snow-fed rivers are at their lowest at that hour. They are also at their coldest. We joined hands and started. The water was icy, and it was a horrible feeling as it crept slowly up my body. It got deeper and deeper, and the current stronger and stronger. My body seemed in an icy vice as I struggled along breast high. I was thankful when it was over, and I got into my tent, had a rub down and a change, followed by a hot breakfast which the bearer had prepared. We were now on the edge of the Lesser Deosi, and decided to camp for a few days while the country was explored for game. I got out my rod and did a bit of fishing. The sport was good and the bag heavy, in spite of the fact that I threw back anything under two pounds, to the horror and astonishment of the coolies.

At the end of the day I gave each of the porters a nice fish, weighing about two and a half pounds or so. It was interesting to watch the preparation for cooking. The camp was pitched far above the tree line, and the only fuel available was grass and grassy roots. A small fire was made with these. The coolies sat round. Each held his fish, first one side, then the other, for a few minutes to the blaze, and then, considering it sufficiently cooked, ate and, I presume, enjoyed it.

Each night at this altitude it froze hard, and one's tent was covered

with three or four inches of snow. Looking out at the coolies one evening sitting in a huddled-up bundle in the snow, I thought they would be more comfortable under some shelter, and sent them out my ground sheet. They were delighted. A fragile tent was made with khud-sticks and the ground sheet, and as many as possible scrambled under. They played just like children. Later in the night I looked out. The ground-sheet shelter stood discarded and half buried in the snow; the coolies formed a lightly packed mass, fast asleep. They are a hardy race and do not even know what comfort is.

After a couple of days, as there was not much evidence of game, we decided to move on. The shikari advised a very early start, as he said there was a "thora kharab jagah" to be passed. When discussing routes the shikari is always on the optimistic side. A rough pony track will be described as "smooth as a high road," a tiny path on the hillside is a "good road," and a goat track up a mountain as steep as a house is an "easy path." When he tells you that it is a rather bad road it awakens your apprehensions, and a nearer view will seldom soothe them.

We started. Climbed up a ridge and over a saddle-back, and here the path ended! We had arrived at the bad place! I stood on the precipice edge. Half a mile below, a dark ribbon in the snow was the river. I could see no way down.

The shikari assured me it was all right, and we started a scramble over the rocks. A few yards, and we came to a sheer drop. Thirty or thirty-five feet below a pine tree trunk rested on a little ledge. The top of the tree was at our feet. This was the path. A coolie wriggled over the edge, clasped the tree trunk and slid down. I most reluctantly followed. I had a horrible feeling that the pole and I would topple over backwards into the gulf below, and wondered which would reach the river first. These cheery thoughts were interrupted by the feel of the coolie's hand guiding my feet to safety.

We now stood on a little ledge five or six feet wide, on either side sheer rock, off which a fly would get a nasty fall. Twenty or twenty-five feet away, and slightly below us, was another ledge connected to ours by another tree trunk. You turned your face to the wall, placed your hands on the rock, and side-stepped along the tree to the next resting-place; from here the road was more comfortable. A tiny little path had been constructed in some wonderful way. It was wedged into, built up, or stuck somehow to the face of the cliff, wound in and out, taking advantage of every little crevice and ledge, and at last reached the foot of the cliff. I was glad when I was safely down, but felt anxious when looking up to see the porters following the same path. They had to side-step the whole way, as there was no room for their packs on the narrow shelf.

We camped at the foot of this cliff and decided to cross the river in the early morning. I noticed that the old bearer declined to wade, and was carried across on the shoulders of a porter. Later I asked him how much

this luxury had cost him. He assured me that he had tipped the man two annas. I am quite sure he was never guilty of such reckless generosity. The reward much more probably took the form of a small donation of tea and sugar. My tea and sugar!

We ranged the hillsides and unsuccessfully stalked some ibex. Traces and tracks of bear were found, but most of them old. It was decided to cross the plateau and try some of the warmer valleys, where the bear might have gone after the tender grasses, etc., springing up as the snow receded.

The night before we crossed there was a heavy fall of snow. The day broke clear and cloudless and, unfortunately, with a strong wind. Soon after the start there were complaints about the glare. It was late in the year for fresh snow, and most of the porters had omitted to bring their snow glasses. These are little bits of green glass stuck on the end of a tin tube. When fastened over the eyes they give the men the stalk-eyed look of crabs. Soon the unprotected porters were quite blind, and had to march along with their faces covered with their puggaries and holding the khud-stick of the man in front as a guide. The shikari and I walked in front and broke a trail through the snow. Even with my thick glasses the glare was blinding. Closing the eyes hardly seemed to bring relief. The reflection from the freshly-fallen snow, backed up by the wind, cut and blistered my face until I felt it must be absolutely raw. We were a miserable crowd as we marched along. We struggled along and at last began to descend. The contrast was startling. In the course of a few minutes we passed from midwinter to glorious spring. All around was fresh green grass and flowers bathed in a delightful sun.

The camp was put up and I got inside my tent as quickly as possible, as the slightest breath of wind on my blistered face was an agony. I examined myself in a small glass and gently stroked my blistered nose. To my horror a complete skin cast came off! Visions of frost-bite flashed across my brain. However, a careful examination of the pink and tender organ showed that it was quite healthy. The porters sent a request for tea to bathe their eyes. I sent them out a supply, and a brew was made.

They sat around and alternately bathed their eyes in and drunk from the bowl. As we journeyed down the nullah I was fortunate to meet a local "tehsildar." He inquired about my sport, invited me to a local polo match, and ordered the villagers to go forth far and wide and discover a red bear at once or incur his everlasting displeasure. The polo match was most interesting. People from all the district collected on a smooth patch of turf by the river bank and sat down in a huge circle. The inside of the circle constituted the polo ground. The number on either side appeared to be unlimited. Newcomers stripped themselves to the waist and joined one or other of the sides. Those whose ponies were too exhausted to continue withdrew and joined the group of spectators. There were no rules of off-side crossing, etc., and it is a wonder numbers were not killed. Occasionally the ball got under a rock or into a hole. A spectator would at great

risk of his life dash out and pick it up, and throw it in the direction of the goal of which he was not a supporter. The "throw in" was curious. One of the side galloped out from his party, threw the ball in the air, and struck it while in flight with his stick. It was very seldom that the ball was missed. Unfortunately the roll of films I took was lost, as I should like to have had a record of that match, and I have never had an opportunity of seeing a similar one. The villagers, spurred on no doubt by the "tehsildar," reported a bear up a very difficult nullah. It would be a hard climb and porters could only carry the smallest loads. The shikari laid down eight seers as a maximum. When a shikari shows such consideration one may be certain that one is in for a stiff climb. And we were. All day long we toiled over rocks, under rocks, through rocks. Sometimes wading through half-melted snow along the river edge, another time carefully scrambling along a rocky knife-edge high up the nullah. At last I was thankful to be told that the next meadow would be the one in which we should camp.

In spite of the difficult march, throughout the day a careful watch had to be kept for game, and every little meadow or hollow was carefully examined before we crossed.

Our proposed camping ground was approached with the usual caution. We were high up, working our way along the crest of a ridge, and carefully looking over we saw two bears quietly feeding in the meadow below, about two hundred feet above the river and about five hundred yards away. A smooth grassy slope led down, and there was a deep gully along which a stalk could be safely made. Easy as it was disaster nearly overtook us. Pressing forward too eagerly, I slipped on the grass and instantly started glissading down towards the river. The shikari, who was below, took in the situation at a glance and drove his khud-stick into the ground below me; I grasped the handle as I slid past and all was well. The stalk was resumed, and getting to about the line of the bears I crept up the crest and looked over. Both bears were just below me and only about twenty paces away. Even now they were unaware of my arrival. I aimed at the nearest just as she spotted me. She fell in a crumpled heap, and I swung over and fired at the other as he rushed down the slope. Hit below the shoulders, he went head over heels down into the bushes below.

The shikari and I gave a shout of triumph and shook hands and congratulated ourselves. A shout from above and we saw, as we thought, the second bear rapidly scrambling along the hillside about one hundred yards away. I fired a couple of shots, the first short. At the second he paused and then rolled down the hillside. We examined the first bear, dead at our feet, and then followed the track made by the second. To our astonishment he lay dead in the bushes! We hurried to where the victim of my third shot lay. Blood-stained grass showed the position, but there was no bear. His path up the nullah was plainly evident, and we at once proceeded to follow him up. He had moved rapidly. At one spot he had laid

down in some half-thawed snow, but probably scenting or hearing our approach had gone on.

It was now getting late and darkness was rapidly setting in. We reluctantly gave up the chase. Next morning we again picked up the trail. The bear had turned and was making his way back down the nullah. Indeed, during the night he must have passed within a hundred yards of the camp. We followed to a bend where he had entered the river and either got across or had been swept away.

A coolie was at once sent to the village to get men to examine the other side of the nullah. No signs were found to show where he had landed, and we heard no more of him. My long chase after the red bear had ended with success.

Next day we struck camp and made our way back into the main nullah. The dâk coolie started off for Srinagar with the two skins and heads rolled up in a blanket, taking care, however, that a piece of skin or paw was visible to let all know that *his* sahib at least had been successful.

Current Literature.

PURDY, W. C. **Activities of Plankton in the Natural Purification of Polluted Water.** *Amer. J. Pub. Health.* 1928, v. 18, 468-75, 4 Charts. [1 ref.]. [U.S. Public Health Service, Cincinnati, O.].

The author states that as a rule plankton and related organisms are most abundant in water which is in process of recovery from pollution by sewage; that is during natural purification, and he groups his observations under the head of three questions which he endeavours to answer by proof.

The questions are :—

(1) Are the activities of these organisms a part of natural purification?

(2) What effects, if any, are produced on water by the presence and activities of these minute forms of life.

(3) What are some of the activities?

The activities of the plankton organisms are chiefly concerned with obtaining food and reproduction of species, the matter of food supply being dominant, and are discussed under the heads of: (1) plankton food; (2) photosynthesis; (3) expenditure of plankton energy. A noted German investigator some years ago classified all plankton organisms as "food producers," and "food consumers," including in the latter those organisms which by means of cilia swept bacteria, etc., into their mouth vacuoles. Observers in general have noted certain plankton forms to be always present and associated with sewage and their decrease or absence when the bacterial content becomes low. In three rivers thus far studied (Potomac, Ohio and Illinois) these pollutional organisms are most numerous in that

part of the stream where pollution is physically evident and decrease as the water regains normal conditions. There is ample laboratory evidence that these organisms are able to consume large quantities of bacteria, the plankton increasing greatly in numbers, the results being based on the following tests :—

(1) Sterilized sewage, inoculated with bacteria only, reached a very high count of bacteria in 4 to 6 days and maintained this for 6 to 10 weeks.

(2) Sterilized sewage, inoculated with bacteria and also with pollutional protozoa showed high bacterial maximum in 4 to 6 days, then heavy and rapid reduction with rapid increase in protozoa about the time of greatest bacterial decrease.

For example, paramecia will not thrive in a sterilized sewage, but when bacteria are present they increase enormously, bacteria decreasing *pro rata*.

Another organism (Colpidium) fails to live in sterilized sewage without bacteria added, although it will live in sterile water to which bacteria have been added, indicating that bacteria are necessary for its existence.

Photosynthesis. The chlorophyll-bearing organisms of the plankton dissociate carbon dioxide and liberate oxygen in the presence of sunlight. Unless the water is already saturated this oxygen will be dissolved to some extent and may be utilized in the aerobic decomposition of organic matter. No experimental data are available but the author suggests that even in a polluted river like the Illinois River the major part of the plankton, volume for volume, is of the chlorophyll-bearing, oxygen-producing sort, and the opinion is ventured that adequate study of this unique activity of the plankton may result in a rating as to its significance in the progress of natural purification.

Expenditure of Energy. Under the microscope plankton activity is most apparent by its physical movement due to the activity of the cilia, which causes local disturbance of the water and causes a mixing up of the various parts of the water. In polluted waters various motile forms in large quantities and in a very active state, and fixed forms with cilia at their free ends, cause a mixing of the waters, as the numbers are great and a complete and intimate mixture of 1 c.c. of water is possible in 1 minute.

What is the probable effect of this continuous mixing and microscopic circulation? In the absence of experimental evidence or data it suggests the probability of it being a factor in purification. In the laboratory, cultures of sewage containing only bacteria retain their foul odour and milky turbidity for 8 weeks or more, whilst like cultures which contain active protozoa in addition to bacteria lost their turbidity and odour in about 10 days. Apparently the organic matter that constitutes the pollution of water constitutes also the food of certain plankton organisms which are numerous ; thus a portion of this polluting organic matter of the water reappears as a multitude of minute organisms whose rapid and continuous movements represent the energy of the organic food consumed. Correlation of energy is effected and the polluted water is started on the road to recovery.

The movement of the larger organisms in attacking masses of organic matter, and their activity in the bottom of the sediments (e.g., Cypris, a plankton crustacean) works the surface of the sediment over and over until this is reduced to a state of microscopic fineness. Certain worms also work in the sediment excavating beneath the mud and depositing it upon the surface.

The author summarizes his paper by stating that, in his opinion, the activities of plankton and related organisms constitute a part of the programme of natural purification of polluted waters, in that their food habits tend to remove a portion of the organic matter, the photosynthetic activities of the chlorophyll-bearing organisms operate to produce oxygen, and the energy of harmful organic matter consumed as food and released to the water in terms of motion serves to furnish an intimate mixing and microscopic circulation during the critical initial stages of recovery from pollution.

W. Rushton.

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Wette, H. Chlorzhal und Chlorbedarf des Wassers. Ein Beitrag zur Beurteilung des Chlorbindungsvermögens. 1 Teil. [**Chlorine Absorption of Water.**] *Arch. f. Hyg.* 1928, v. 99, 143-57. [12 refs.]. [Hyg. Inst., Univ., Jena].

A measurement of the chlorine absorption is useful in two ways; under certain circumstances it provides a better criterion than does the oxygen absorbed as measured by the Kubel-Tieman process of the presence of certain albuminoid bodies, also it gives an indication of the dose necessary when the water is to be chlorinated as an adjunct to purification. Various methods have been adopted to determine chlorine absorption and the value obtained depends on the method adopted. An excess of the reagent, chlorine or hypochlorite, is added to a measured volume of the water and the excess estimated, after the lapse of a stated time, by addition of potassium iodide and acid, and titration with sodium thiosulphate in the usual way. The difference between the chlorine added and that left over gives the amount taken up by the water. The reaction may be allowed to take place either at room temperature or with the aid of heat. Another *modus operandi* is to fill a number of measuring cylinders with the water to be examined and add chlorine in a range of doses covering the anticipated value of the absorption; then, after lapse of the proper time, test the samples with benzidine chloride solution. A trace of excess chlorine gives blue-green colour, so that the dose which is just enough to give excess under the given condition is determined. In general, the various modifications of the former scheme are the better adapted to appraise the sanitary quality of the water; the latter to determine the dose when it is a question of chlorinating a supply. Boiled tap water to which urea was added in doses 0, 1·25, 5·0, 13·75 p.p.m. showed chlorine absorption 3·4, 8·1, 18·0, 34·4

p.p.m. respectively when tested by the method of Froboese (large excess of reagent and heating); by the Bruns method (addition of 1-2 p.p.m. of chlorine, reaction in the cold and subsequent titration of the excess) the presence of the urea made no difference, similarly by the Olszewski method (testing for slight excess with benzidine). It is concluded that "albuminoid" substances like urea do not affect the dose required for chlorination, and the same was found to be true of carbohydrates, represented by sugar and of fats as represented by olive oil.

Jena tap water, after boiling, gave a chlorine absorption figure by the Bruns method despite the fact that the supply was chlorinated; the cause of this was traced to the presence of bicarbonate. The boiled water still held 4·9 degrees of carbonate alkalinity and a series of experiments with sodium and calcium bicarbonates showed that a high content of bicarbonate and a high pH value favour a high chlorine absorption, so that the water which will absorb most chlorine is one rich in bicarbonates which has also been deprived of its free CO_2; excess of free CO_2 over that necessary to keep bicarbonates in solution will result in a reduction of pH and so reduce the chlorine absorption figure. [It would seem important to keep this work in mind when chlorinating a water which has been softened or treated with "excess lime" and subsequently recarbonated.]

GUY T. P. TATHAM.

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POINDECKER, H. Ueber den Wert der Sanocrysinbehandlung der menschlichen Lungentuberkulose. **[The Value of Sanocrysin in Pulmonary Tuberculosis.** *Seuchenbekämpfung.* 1927, v. 4, 170-78.

The author gives a useful summary of the preliminary work on sanocrysin by MÖLLGAARD in Denmark and describes the formation, in March, 1925, of the Austrian Sanocrysin Committee, on the findings of which his article is, for the most part, based. He briefly discusses the previous efforts to exploit gold salts in the treatment of tuberculosis from the work of R. KOCH and BEHRING onwards and regards MÖLLGAARD'S sanocrysin as the least toxic of the gold preparations hitherto suggested; though, like others who have tried it in human tuberculosis, he is fully alive to its dangers if used in unsuitable cases or administered in too large doses.

As to whether its action is to be explained as an instance of true chemotherapy or merely through the production of focal reaction the author is uncertain. The finding of the American National Tuberculosis Association that a dilution of 1-2,000 of sanocrysin fails to kill tubercle bacilli *in vitro* does not, in Poindecker's opinion, settle the question, since even salvarsan itself is not spirochæticidal *in vitro* in the dilutions, which are found to be active in therapeusis. He is impressed with the fact [which the reviewer can fully endorse from his own experience] that sanocrysin often leads to a marked diminution or a total disappearance of tubercle bacilli from the

sputum, an observation which suggests, though it does not prove, that sanocrysin has a direct effect upon the bacilli *in vivo*.

Turning to animal experiment, Poindecker gives a list of workers who have *failed* to confirm the animal experiments of MÖLLGAARD [but, curiously enough, he makes no mention of the confirmatory findings of MADSEN and MÖRCH, CUMMINS and others who have been able to substantiate the fact that sanocrysin, applied in appropriate doses and at the right stage of the disease, can arrest the progress of, or even cure, artificially induced tuberculosis in rabbits].

For the combined use of MÖLLGAARD'S anti-tuberculous serum, Poindecker has nothing favourable to say. He regards it as insufficiently supported from the theoretical and as practically inactive from the clinical point of view. "What, then, remains," he asks, "to be said for the practical value of sanocrysin in the treatment of tuberculosis?" It is a simple gold salt treatment which like the other "reaction-therapies" may give rise to very useful or very dangerous results according to the severity of the cases treated and according to the size of the doses employed. It has, however, the advantage over other methods of gold treatment that sanocrysin, for a given gold content, is relatively slightly toxic, and so can be given, whether in individual doses or in total amount, in larger quantities than other gold preparations. The fact that large doses lead to a definite diminution of the tubercle bacilli in the sputum suggests that perhaps sanocrysin may have brought us a stage nearer to a true chemotherapy in tuberculosis and renders further confirmation of the action desirable. It is beyond question that sanocrysin, regarded as nothing more than a reaction-producing substance to be used in small doses, is no better than many other therapeutic substances of this nature. Only if it proves to be a chemotherapeutic method in the strict sense of the word will it attain to a permanent place in the treatment of phthisis. The real value of sanocrysin must necessarily be very critically examined since the cost of production is very high. In Austria 1 gram costs about 24 shillings and so a "course of treatment runs to from 120 to 140 shillings." The conclusions of the Austrian Sanocrysin Committee may be summarized as follows:—

"Although the treatment of human tuberculosis by sanocrysin involves certain risks depending on individual susceptibility, these may be, to a great extent, avoided by careful dosage and sufficiently exact observation of cases (preferably under institutional conditions of study). Clinical investigations and animal experiments show that moderate doses of sanocrysin are without ill-effects on healthy kidneys.

The use of MÖLLGAARD'S serum in sanocrysin treatment is superfluous and not without danger. Intestinal symptoms and pathological states of the kidneys are to be regarded as absolute contra-indications to sanocrysin. The management of a course of treatment should be guided by close attention to the reactions and must always have the most definite reference

to the peculiarities of the individual patient. The sanocrysin treatment of lung tuberculosis gives much the same results as follow other methods of treatment. The diminution of tubercle bacilli in the sputum so often observed suggests that there may perhaps be an element of true chemotherapeutic activity in sanocrysin but this suggestion gains no support from *in vitro* tests or animal experiments."

S. L. Cummins.

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Reviews.

How to start in General Practice. By Isaac G. Briggs, M.R.C.S., L.R.C.P. London: John Murray. Pp. viii + 158. Price 6s. net.

Although this little book is chiefly intended for the recently qualified man starting on his own with a stout heart and lean purse, yet much of the information contained in it should prove equally useful to anyone taking to general practice at later stages of his professional career.

After dealing with the various matters needing attention immediately after qualification, the author goes on to discuss the different kinds of practice open to the beginner, and the methods of obtaining each of these. Many pitfalls are open to the unwary while engaged in purchasing a practice, and very sound advice is given as how to overcome these difficulties and dangers.

As it is usually necessary to purchase or build a house, the various methods by which a loan for this purpose may be obtained are described, and the great advantages which may be gained by joining an approved building society are shown. Sound advice is then given as to the actual planning and building a house, and the material used in its construction, and also as to furnishing, especially in connexion with the consulting-room and its immediate precincts.

Methods are described for keeping all necessary records in a simple manner, and the importance of accurately maintaining these records is duly emphasized.

Lists of equipment, which the author considers essential before "putting up one's plate," are given in detail, with the names and addresses of the various instrument makers and other firms from which they may be obtained.

Finally, the fitting-up of the dispensary is discussed, and lists of necessary drugs are given with full particulars as to the compounding of all essential mixtures, etc., in the most practical and economical manner.

The whole book is full of useful advice and suggestions, and, although others may differ from the author in minor details, there is no doubt that anyone starting practice for the first time will find the book invaluable, and

even the experienced practitioner may derive great profit by many of the suggestions contained in it.

THE PRACTICE OF UROLOGY AND SYPHILOLOGY. By Charles H. Chetwood, M.D., LL.D., F.A.C.S. Fourth Edition. Oxford University Press: Humphrey Milford. 1928. Pp. xii + 879. Price 42s. net.

During the seven years which have elapsed since the previous edition of this work was published, considerable progress has been made in urology, and the author has endeavoured to bring the book thoroughly up to date. In doing this, although he has added much new material, he has only increased its size by 39 pages. The sections on urethroscopy and cystoscopy have been revised and enlarged. Regional and local anæsthesia in urological surgery are fully discussed. For inducing local anæsthesia in the urethra, the author appears to have a preference for a local anæsthetic incorporated in a lubricating jelly. The uses of diathermy and radium are discussed, but practically no details are given with regard to their mode of employment. In dealing with litholapaxy, no mention is made of Canny Ryall's cystoscopic lithotrite. A surprising omission is to be found in the section dealing with the treatment of pyelitis; no mention is made of the treatment by alkalis. The administration of equal amounts of urotropin and acid sodium phosphate with a copious draught of water is advocated. If these drugs are given in this manner, the chances are that formaldehyde will be set free in the stomach. No mention is made of any tests, such as Rimini's, by which it can be determined whether urotropin or formaldehyde is being excreted in the urine. It is interesting to note that tight-lacing is still mentioned amongst the contributory causes of nephroptosis, although over twenty years have elapsed since Trakaki drew attention to the fact that this condition was commoner amongst Arab women, who do not wear corsets, than among European women. The statement that the undescended testis is particularly prone to become the site of malignant disease is one which will nowadays be disputed by many British surgeons, who maintain that it is no more likely to become so involved than the normally placed testis. No description is given of the radical operation, which the author advocates, for malignant disease of the testis. He also fails to mention that whilst the radical operation is said to give 30 per cent "cures," which is twice that obtained by simple orchidectomy, it has a mortality of 12·6 per cent. The descriptions of operations, although good on the whole, are too brief and lack detail. Thus transperitoneal nephrectomy is dealt with in half a page, and resection of the urethra for stricture is disposed of in thirteen lines. In describing the latter operation a straight perineal incision is advocated, no mention being made of the inverted Y-incision, which is more generally used in this country. No reference is made to the valuable work done by Hamilton Russell. The book is well bound, clearly printed and profusely illustrated. The plates depicting

urethroscopic and cystoscopic conditions are particularly good. As a work of reference it is a valuable one, and it is a tribute to the knowledge and industry of the author.

D. McK.

TUBERCULOUS INTOXICATIONS; A CLINICAL STUDY. By Joseph Hollós, M.D. Edinburgh: E. & S. Livingstone. 1928. Pp. 132. Price 10s. 6d.

If enthusiasm in the enunciation of one's theories evokes a similar response in the reader, the success of Dr. Hollós' work is assured, for we have seldom read a monograph in which this quality is more striking. He holds the opinion that the symptoms of many diseases not generally recognized as tubercular in origin are really due to a tuberculous intoxication, the result of a lytic immunity established in the members of a tubercular family modifying the action of a reinfection.

This intoxication, acting in a great part on the endocrine glands and sympathetic nervous system, gives rise to diseases described by the vast majority of physicians as neurasthenia, rheumatism, neuralgia, thyrosis, hysteria, epilepsy, dysmenorrhœa, psoriasis, and also many intestinal disorders.

While we are impressed with his sincerity, we cannot help being at variance with him on many points. We cannot agree that even though his quotation that 22 per cent of the children of drunkards are tubercular were correct, the tuberculosis is caused by parental alcoholism acting directly on the offspring; the poverty so often resulting from drunken habits in parents is, we consider, of more account.

The fact that Dr. Hollós convinced himself that the first epileptics he examined for the condition proved to be suffering from this tuberculous intoxication does not convince us that the majority of epileptics do so, or that the disease is evidence thereof, nor should we be satisfied with the history of a tubercular father and grandfather, plus the presence of rough breath sounds at the right apex, as sufficient to establish the diagnosis of an old tubercular infection.

For the conditions he describes, he finds treatment by Spengler's immune blood most satisfactory. Administered in the most minute doses at first, by injection, percutaneously or by the mouth, its results in Dr. Hollós' hands appear to be marvellous; few of the many cases described have not reacted favourably, most of them after the first administration. It is no wonder that he describes tuberculins, and especially this immune serum, as remedies as specific for the tuberculous as salvarsan is for syphilis.

We hope that in general use the results of these remedies will be as good as those Dr. Hollós has had.

G. F. D.

Correspondence.

MEDICAL APPRECIATIONS.

TO THE EDITOR OF "THE JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—There must be many prospective candidates for the examination for promotion to Lieutenant-Colonel who will be grateful to Colonel Sewell for his article on the writing of appreciations which appeared in the July number of the Journal, but as he is alone responsible for the opinions expressed those prospective candidates must still be in a quandary as to what is required of them in the examination.

Would it not be possible for the stamp of authority to be placed on Colonel Sewell's communication?

I have a strong suspicion that the examination at which I presented myself was responsible for the article by a "Staff Officer" in the ROYAL ARMY MEDICAL CORPS JOURNAL of August, 1927.

At this examination which was held in October, 1926, Requirement No. 1 was "As A.D.M.S. of the striking force write an appreciation of the situation from its medical and hygienic aspects." All candidates took Major-General Hannay's communication of March, 1924, as a guide, and the staff officer on the examining board severely criticized their appreciations because they were not written in accordance with the headings given in Training and Manœuvre Regulations 25 (4). No comment was made at the time by the President of the Board, and none of the candidates were given an opportunity to attempt to justify their work. Subsequently, however, as a result of protests, a discussion was held when the President of the Board stated that Major-General Hannay's communication was "out of date" and that the scheme given in Colonel Sewell's communication in the Journal of September, 1926 (which had only just arrived in India) should have been taken as a guide, and the requirement from the candidates was an appreciation by an A.D.M.S.

I merely mention these facts to show how the fate of the unfortunate candidates at this examination may completely depend on the opinions of individual examiners who may include *p.s.c.* officers.

I think this may be emphasized by an experience which I had four months later.

In February, 1927, I was detailed for a staff ride at Delhi as D.M.S. of one of the two syndicates and submitted an appreciation as D.M.S. with the following headings :—

I. Object of the medical services :

(1) Control of epidemic and other diseases.

(2) Rapid evacuation of casualties from the front.

(3) Establishment of sufficient hospital accommodation.

II. Medical considerations which affect the attainment of this object:

(1) Climatic conditions.
(2) Supplies.
(3) Topographical influences.
(4) Prevalent diseases.
(5) Class of wounds likely.
(6) Estimation of casualties.

III. Plan.

(1) Control of disease.
(2) Evacuation of casualties.
(3) Hospital accommodation.
(4) Location of medical units.

The comments on this appreciation by "G" branch of the syndicate were "written purely from the point of view of the medical services. The exhaustive examination of factors is sound, but this work would actually have been done during the preparation of the plans for mobilization in peace time."

The comment of the director of the syndicate was: "I agree with the above statement. A very good bit of work." At the conference which was held at the conclusion of the staff ride, I asked the director of the ride (the Director of Military Training in India) if he approved of the form of the appreciation, but he would not commit himself. There was no medical officer on the directing staff.

Although it would perhaps be difficult to lay down a definite scheme for the writing of medical appreciations, could not some guiding principles such as those formulated by Colonel Sewell be incorporated in Regulations, say in R.A.M.C. Training, Chapter II. This would perhaps avoid the divergence of opinions which has been shown in articles on the subject which have appeared in the Journal during the past six years, and would tend to the peace of mind, not only of candidates for examination, but of examiners, and officers undergoing individual training.

I am, etc.,
W. Bissett,
Major, R.A.M.C.

Lebong,
August 13, 1928.

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Obituary.

SIR EDWARD WARD.

AMONG the many public services which the late Sir Edward Ward rendered to the country and which have been recorded in the Press, those which he rendered to our Corps have not been fully noticed, and it is only due to his memory that we who have so greatly benefited by them should realize what they were. Sir Edward, throughout his service in the Army, was always our staunch friend, and as an Army Service Corps officer was ever ready to assist us in every difficulty, despite of regulations.

During the South African Campaign, and most notably during the Siege of Ladysmith, which only held out by his organization of supplies, his first thought was for the hospitals, and he was instrumental in smoothing over our well-known difficulties with many adverse critics.

At the conclusion of the war, as permanent Under-Secretary of State when Lord Midleton, then Hon. St. John Brodrick, was Secretary of State for War, Sir Edward became chairman of the Commission for the reorganization of the Army Medical Services, and was the active agent in securing all the benefits that we have reaped from it. Without going into details it may be stated that we owe the Royal Army Medical College to him entirely. He had also a large hand in the improvement of conditions of the service of the other ranks of the Corps, and of the Queen Alexandra's Imperial Military Nursing Service, and later, when Lord Haldane was Secretary of State, Sir Edward presided at the meetings of the conclave of the university and public schools representatives which produced the Officers Training Corps. Here again the Medical Service was not forgotten, and the medical units of that organization were instituted.

Our Corps Journal itself owes its origin to his good offices, and it is only fitting that we should think of him with gratitude and cherish his memory. As he said on a privileged occasion, "fifty years' work for the soldier is not bad," and that epitomizes his career.

Original Communications.

BACILLUS AERTRYCKE—THE POSSIBLE CAUSATIVE BACILLUS OF CANINE TYPHUS (STUTTGART DOG DISEASE).

By Major J. A. MANIFOLD, D.S.O.
Royal Army Medical Corps.

The high mortality among dogs in India is always a source of anxiety to dog lovers, and probably no part of the population is more affected in this respect than the military officer. The mortality appears to be higher among dogs bred and born in England. The cause of death seems nearly always to be ascribed by the owner to "tick fever," but, if careful inquiries are made, it will be found that in many cases the symptoms do not correspond with the textbook descriptions of that disease, and no examinations of the blood have been carried out by a competent observer. The diagnosis has often been made on the advice of some unqualified person in the station "who knows something about dogs."

It is not the intention of the writer to decry the "unqualified dog practitioner," as many such take up this line of work owing to their natural liking for dogs quite apart from any financial considerations; but it stands to reason that the differential diagnosis in such cases must frequently be unscientific and of a rough-and-ready description. Really skilled, up-to-date scientific advice on dog diseases can only be available in very few stations in India at the present day.

In Poona, as in other stations, the mortality among dogs is always high, and popular opinion seemed perfectly contented with a diagnosis of tick fever. In 1926 the writer examined several blood-films of dogs which were declared by their owners to be suffering from tick fever, but was unable to discover any sign of a piroplasma. In fact, the microscopic results were so consistently negative, and the opinion of the owners of the dogs that the disease was tick fever so positive, that one began to fear that any little skill formerly possessed with a microscope was departing with the onset of old age. Finally, however, a stained blood-film, said to be swarming with piroplasma, was brought to the laboratory, and the granules of deposit in a particularly badly-stained Leishman film were demonstrated as the elusive protozoa. This was heartening in view of previous failures to discover piroplasma in blood-films.

On going carefully into the symptoms of the majority of the cases these seemed to be divisible into two groups:—

(*a*) Pyrexia, loss of appetite, thirst, vomiting, often not marked, great wasting and weakness. These symptoms lasted ten to fourteen days, and if improvement occurred there was left behind a prolonged debility during which the animal usually became covered with sores, etc., and eventually

died of septicæmia. Ulcers in the mouth during the illness might, or might not, be a prominent feature.

(*b*) A type similar to the above, but with gastric and intestinal symptoms very marked. Distressing vomiting, great abdominal pain and ulceration of the mucous membrane of the mouth being the main features. Death usually occurred in seven to ten days.

One of the writer's own dogs developed the disease of the latter type, and was nursed for ten days through what closely resembled an attack of enteric fever in the human being, except that vomiting was a somewhat prominent symptom. The abdominal pains then became so agonizing, peritonitis being obviously present, that one gave up the unequal contest and put the poor creature out of his pain.

Type (*b*) cases are obviously canine typhus or Stuttgart dog disease, and present no difficulty in diagnosis, if one has read the textbook descriptions of this disease. But one of the objects of this paper is to put forward the view that in all parts of India there are probably large numbers of Type (*a*) cases which are simply a milder, or less acute form of the Stuttgart dog disease, and which in the absence of skilled scientific veterinary advice are usually diagnosed as tick fever, and treated as such. As will be seen later, there appears to be reason to believe that this disease is caused by infection with organisms of the Salmonella group, and the appropriate treatment would therefore appear to be by salines, etc., as in treating human infections of food poisoning, in lieu of the trypan-blue injections so empirically administered to most cases.

From a study of the symptoms it seemed obvious that the infective agent would most probably be discovered by examination of the intestinal contents. The local pack of hounds was known to be attacked, usually in the autumn, with a disease causing pyrexia, wasting and death, and arrangements were made to have any such hounds carefully watched, and any stool passed sent at once to the laboratory. Only two stools were examined, as orders for transfer of station arrived within a few days. In one case an almost pure culture of pure *B. aertrycke* (Mutton) was found on the litmus lactose agar plate.

The bacteriological findings appeared therefore to agree with the clinical symptoms, and arrangements were made at once for the transmission of further specimens from sick dogs to the laboratory, and also for the examination of serum from as many pariah dogs as possible, as these animals might be carriers. Two such dogs were shot outside the laboratory and the serum obtained was tested against the bacillus. In both cases the organism was agglutinated to a reasonable titre; one in a dilution of 1 in 125, and the other in a dilution of 1 in 50, to the best of my recollection.

Work on this subject then had to cease, owing to transfer of station, but the strain has been kept in the hope that time would become available to go further into the matter. This unfortunately has been impossible, and

these notes are published in the hope that some other D.A.D.P. will go into this question fully. The writer will be glad to forward a subculture of the strain in question to anyone interested. Major R. F. Bridges, R.A.M.C., was recently kind enough to test it against specific sera of the Salmonella group, and found also that it agglutinated with specific serum of *B. aertrycke* (Mutton) only. If this bacillus can be proved to be the cause of the disease, hundreds of valuable dog lives might be saved by the use of a prophylactic vaccine in the future, and a vaccine might also be tried in treatment. If the writer is correct in his assumption that the disease is widespread among dogs in India, and that the milder type is usually undiagnosed, the cause is worth investigation, even though the above results are not confirmed.

It is in the hope of encouraging such research that the following ideas which were in the writer's mind two years ago are recorded :—

(1) Taking India as a whole, and particularly those stations in which skilled scientific veterinary advice on dog disease is absent, a high percentage of the cases diagnosed and treated as tick fever are not suffering from that disease.

(2) The greater proportion of these cases, if examined bacteriologically with the same attention to detail as is given in human cases of enteric fever (e.g. early examination of blood and fæces, freshness of specimens, etc.) might prove to be infections by an organism of the Salmonella group, most probably *B. aertrycke*.

(3) The cause of canine typhus, or "Stuttgart dog disease," appears to be *B. aertrycke*, and this bacillus may also be responsible for the milder or more typhoid-like disease which is frequently diagnosed as tick fever. The name canine typhus appears to be a complete misnomer, and gastro-enteritis (*B. aertrycke*) is probably the correct term to use.

(4) Pariah dogs may prove on examination to be heavily infected, and to be the probable carriers, although mice as carriers would also have to be considered.

(5) If the above presumptions prove correct, the infection is almost certainly carried by flies, and this would account for the sporadic way in which dogs are infected. Fleas and dog lice in the rôle of carriers might also be investigated.

(6) If pariah dogs' fæces are the source of infection, and flies the carriers, might not some of the curious little outbreaks of food poisoning which occur among the troops be due to the same cause? Flies and pariah dogs' excreta are never far from barracks in this country.

(7) Lastly, if *B. aertrycke* can cause a ten-day pyrexia of a typhoid nature in dogs, might not some of our ten-day enteric group pyrexias among troops be due to the same cause ?

These ideas may only have been vain imaginings, but at the same time it is thought that an investigation on the above lines may prove of some interest to a D.A.D.P. looking for a subject for research, and that the results may be well worth the trouble and time entailed.

I am greatly indebted to Major H. C. Brown, C.I.E., I.M.S. (Retd.), of the Wellcome Bureau of Scientific Research, for providing me with the following references to the literature concerning the occurrence of aertrycke infections in dogs. Apparently no such finding has previously been reported from India, and only once in England.

In the Medical Research Council's Report, No. 91 (Savage and Bruce White) [1], a case is quoted of *B. aertrycke* (Newport) having been once isolated from a dog suffering from enteritis.

In an investigation undertaken at the Wellcome Bureau of Scientific Research [2] no members of the Salmonella group, pathogenic to mice, were found in an investigation of 100 random samples of fæces from dogs.

In an article, "Domesticated Animals as Sources of Bacilli Pathogenic to Men," by W. G. Savage [3], there is no record of any member of the Salmonella group being found in the dog.

Recently also I have come across, in Huytra and Marek's "Special Pathology and Therapeutics of the Diseases of Domestic Animals" [11], the statement, in the discussion of the ætiology of the disease, that Huytra in all cases succeeded in isolating a colon bacillus and a virulent proteus strain from the contents of the severely inflamed and hæmorrhagic intestines.

It is also stated that Scheibel and Zschokke found in the blood bacilli resembling those of chicken cholera and swine plague.

These results apparently have not been confirmed, as Professor Wooldridge states in vol. i of the "Encyclopædia of Veterinary Medicine, Surgery and Obstetrics" (1923) [12]: "The actual cause of canine typhus is not definitely known, but the lesions of the stomach and intestine usually contain an enormous number of the organisms of the *Bacillus coli* type, which may however be due to a secondary invasion. On the other hand, *B. coli* may possibly be the cause of the infection, and this view is somewhat supported by the results which frequently follow treatment of the disease by means of vaccines prepared from a canine strain of that organism."

A very brief account of the symptoms, etc., of canine typhus and tick fever is given below, as possibly other medical officers may be interested and may not have seen any literature on the subject. The notes on canine typhus are partly extracted from the two volumes on diseases of animals quoted above, but are mainly from the "Encyclopædia of Veterinary Medicine" [12].

Canine Typhus.

Epizootic Gangrenous Stomatitis and Gastro-enteritis; Stuttgart Dog Disease.

History: Described by Hofer under the name "typhus" in 1850. The disease appeared in Germany in 1898, and in the following years in other countries as a severe plague. In this outbreak Klett, who observed it in the autumn in and around Stuttgart (hence the name Stuttgart dog disease),

gave the first clinical description. Various observers in other countries described the disease. There was a widespread epizootic extension in middle Europe, 1898-1900, since when the disease has largely disappeared from these countries.

Ætiology.—Unknown ; organisms of coli group suspected. Some cases are recorded in which experimental feeding of healthy dogs with discharges of affected animals has produced the disease, but there were many failures. Possibly dog lice or fleas may act as carriers.

Symptoms.—In Europe old dogs appear more susceptible than young dogs. (This does not appear to be the case in India.) Four types of the disease are recorded : Acute, subacute, mild, and chronic or atypical :—

(1) *Acute.*—Severe vomiting, dullness and depression. Great thirst. Constipation followed by diarrhœa. Both vomit and fæces may contain blood ; weakness ; rapid loss of flesh ; eyes dull and sunken ; mouth cold and clammy. Temperature at first raised, in later stages becomes subnormal. If the case last several days, there is extensive ulceration of the mucous membrane of the mouth, particularly along gums and cheeks. Fatal in eighty to ninety per cent of cases.

(2) *Subacute.*—First symptom often cough due to pharyngitis (this was marked in the case of the writer's dog referred to above, and was present several days before acute symptoms supervened). Occasional vomiting, dullness, thirst, constipation followed by diarrhœa, later tenesmus, which may be mistaken for constipation, ulcers on gums, cheeks and tongue. Vomiting gradually becomes more frequent. Pyrexia 2° to 3° F. In later stages temperature subnormal. Emaciation and weakness, death in about ten days in at least fifty per cent of cases.

(3) *Mild.*—Dullness, anorexia, thirst, vomiting. Temperature may be normal or elevated 1° or 2°—ulceration of mouth may occur. Irregular action of bowels, possibly slight diarrhœa.

(4) *Chronic or Atypical.*—Persistent vomiting, irregular action of bowels, great thirst, progressive emaciation, mucous membranes anæmic, temperature normal, or later subnormal. After ten to fourteen days symptoms may become very acute and such cases are usually fatal.

The cases discussed by the writer appear to have resembled, in the main, the mild or subacute type as described by Professor Wooldridge, but diarrhœa was not always a marked feature, and vomit was not necessarily blood-stained, even in the later stages.

Death seemed to be the ultimate end, whatever the type of case.

Variations in the clinical symptoms appear to have occurred in different outbreaks, and sometimes ulceration of the mouth appears to have been absent, even in fatal cases (Albrecht). Pyrexia, vomiting, wasting, thirst, dullness, constipation followed by diarrhœa, and ulceration of the mouth would appear to be the main symptoms, but all may vary in intensity in individual cases.

Anatomical Changes.—Mainly confined to alimentary tract ; ulcers and

sloughs in mouth; mucous membrane of stomach inflamed, hæmorrhagic and possibly ulcerated. Bowels in some cases inflamed and hæmorrhagic, particularly the small intestines, but at other times little enteritis. Abdominal lymph glands swollen and possibly hæmorrhagic. In the chronic forms lesions may be entirely absent. At other times ulceration of the buccal mucous membrane is present.

Very brief notes on tick fever, extracted from C. M. Wenyon's "Protozoology" vol. ii [10], and from Major General T. H. Symons' article in the *Indian Journal of Medical Research*, vol. xiv, 1926, p. 293, are given below.

These publications should be read by any medical officers interested in the matter.

Tick Fever or Babesia of Dogs

The above term, as used in India, probably includes two diseases with different symptoms and causation.

(*a*) Due to *Babesia canis*, the cause of malignant jaundice in dogs.

(*b*) Due to *Babesia gibsoni*, the cause of a progressive anæmia.

In both diseases pyrexia and anæmia occur.

I.—*Babesia canis Infections.*

(1) *Babesia canis* (Piana and Galli-Valerio, 1895) occurs in many countries, and was described in India by James (1905), in Assam, and by Webb (1906), and Christophers (1907). It is a pear-shaped protozoon 4·5 to 5 microns in length, pointed at one end, bulbous at the other. There is usually a vacuole in the cytoplasm. The nucleus, as seen in dry films stained by Romanowsky's method, consists of a deeply-staining granule near the pointed end, while extending from it is a string of fine granules. The pear-shaped form goes through a definite evolution, becoming rounded in form, then budding is seen, after which two pear-shaped parasites are found which remain attached by their pointed extremities until separation occurs. Division into four or more parasites may occur. For full details see Wenyon's "Protozoology."

(2) *Transmission in India* is due to the bite of *Rhiphicephalus sanguineus*, and it was shown by Christophers [9], who also worked out the cycle of the parasite in the tick (1907), that the nymphs and probably the adults which resulted from eggs laid by an infected tick were infective.

(3) *Symptons.*—In acute cases pyrexia, progressive anæmia, jaundice and hæmoglobinuria, frequently terminating fatally. In more chronic types pyrexia may be only slight, there is a mild anæmia, and jaundice may, or may not, be present. Indigenous dogs, though healthy, may be found to be harbouring the parasite.

(4) *Post-mortem Appearances.*—Marked jaundice of internal organs, enlargement of spleen, swelling and congestion of kidneys. Smears of the

internal organs may show the parasites to be more numerous than in the peripheral blood. Sections of the kidney show hyperæmia, and degeneration of the epithelium of the tubules, granular and epithelial casts. Parasites are found in red cells as round, irregular or pear-shaped individuals. Budding forms, leading to pairs of pear-shaped forms, are common. In heavy infections fifteen or more parasites may occur in a single cell.

II.—*Babesia gibsoni Infections.*

Babesia gibsoni (Patton 1910), discovered in dogs in Madras by Patton (1910), and later in jackals. It is smaller than *B. canis* and pear-shaped forms are absent. It is usually seen as a small ring or oval, occupying not more than an eighth of the diameter of a red cell. A single dot of chromatin, or two dots connected by a thread, may be seen. Occasionally large ovoid forms as long as half the diameter of the cell, or elongate parasites nearly as long as the cell itself, occur. Reproduction is by binary fission and the cell may be crowded with parasites.

Symptoms.

(1) *Pyrexia.*—(i) Four to five days with relapses of about same period—highest rise as a rule about 104° F. (normal 100·6° F.); (ii) may be only one day's fever, a period of fever, or disease may become chronic without noticeable fever.

(2) *Anæmia.*—Pallor of ears earliest sign. This pallor is also seen on the inside of the thighs and abdomen and, later, on gums, inside of lips and tongue.

(3) Enlarged spleen and possibly tenderness over spleen, particularly in early stages.

(4) Dry scurfy coat, with loss of hair in patches, particularly over ribs.

(5) Slackness, loss of appetite, bad temper.

Symons and Patton [4] emphasize the importance of clean grease-free slides; needles and scissors dry and free from dust, and thorough cleanliness of the dog's ear when making blood-films. If these details are attended to and the film deeply stained, there is little difficulty in finding the parasite, but if the dog's ear and slide are dirty, the parasite will certainly be missed.

I have to thank Major H. C. Brown, C.I.E., I.M.S.(Retd.), and Lieutenant Colonel E. C. Webb, O.B.E., R.A.V.C., for giving me references to the literature of the above diseases and Salmonella infections in dogs, and also Major R. F. Bridges, R.A.M.C., for his trouble in isolating the specific phase of the bacillus in question, and testing it against specific sera of other members of the Salmonella group in order to confirm the diagnosis.

Summary.

(1) *Bacillus aertrycke* (Mutton) is reported, apparently for the first time, as having been recovered from a dog (October, 1926).

(2) Agglutinins to this bacillus were found to be present in the serum of two pariah dogs examined.

(3) The suggestion is put forward that *B. aertrycke* may be the cause of canine typhus, and that this disease in its subacute form is common in India, and often diagnosed as tick fever.

(4) An investigation into the question of the occurrence of Salmonella group infections among pariah dogs, and careful bacteriological examinations of dogs *suspected* to be suffering from canine typhus or tick fever is also suggested with a view to proving or disproving the above.

(5) Short notes from the literature concerning canine typhus and tick fever are given for the information of any medical officers interested.

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MILITARY HYGIENE AND PATHOLOGY IN INDIA.

By Lieutenant-Colonel J. MACKENZIE, V.H.S.
Royal Army Medical Corps.

III.—ORGANIZATION.

(Continued from p. 349.)

In a country with no public opinion and an enervating climate it requires some unusual stimulus to bring new measures into being. The birth of reforms is painful and difficult.

In Mother India the stimulus may take the form of a dispatch from London or may consist of some alarming or catastrophic event in the country itself.

The hygiene and pathology services of the Army in India owe their inception, not to the gradual appreciation of the advantages of a health organization, but to the compelling force of thousands of dead British soldiers—dead of enteric fever in the eighties and nineties, and with a death-rate increasing year by year in rapid crescendo to its climax in 1898.

Year		Admissions		Deaths
1895	..	1,544	..	383
1896	..	1,795	..	445
1897	..	2,050	..	556
1898	..	2,375	..	654

In June, 1897, the Government of India called for a report on Ambala *re*: (1) The health of the troops, with special reference to enteric during the past year and cold weather; (2) The sanitary state of the station; and (3) The water supply. "*It should also be stated whether the water has been examined by any bacteriological specialist.*"

Here was the match that had fired the train. There was not at that time a single bacteriological laboratory (military or civil) in the whole of India, although a proposal was on foot to establish one (civil) at Agra. Who was there competent to undertake the bacteriological analysis of water?

After much consultation between the civil and military medical authorities it was discovered that there was in India an officer who had been for five years assistant professor of hygiene and teacher of bacteriology at the Army Medical School, Netley. This was Surgeon-Major Davies of the Army Medical Staff. It was agreed that Davies was the man.

But those were the days when the man was everything; ways and means were of no account; bricks had to be made without straw. Davies demanded a native assistant for cleaning up, packing, moving heavy articles and to do the mechanical work. This was considered an extravagance. The P.M.O. India, in backing him up, remarked: "When visiting

Dr. Cunningham's bacteriological laboratory in Calcutta last winter, I noticed that he had a native employed for such purposes." This settled the matter; precedent is everything in India.

In September, 1897, the proposal took definite shape as follows: "That Surgeon-Major Davies be temporarily appointed to the office of the P.M.O. India *as a bacteriological investigator*, to carry out the examination of the water supply of cantonments *and other bacteriological investigations* connected with the sanitation of military stations for one year."

In October, 1897, it was expected that Professor Koch would be coming to India to conduct investigations into the causes and etiology of enteric fever in Indian cantonments, and it was thought that Koch's work would be greatly facilitated if he had the assistance of Davies, and the latter would gain further experience by the association.

On October 4, 1897, the Government of India sanctioned, as a tentative measure for the period of one year, the proposal that Surgeon-Major Davies be attached to the office of the P.M.O. "for the purpose of carrying out bacteriological examinations and sanitary investigations in cantonments."

Davies joined the office of the P.M.O. India on January 1, 1898, the first director of hygiene and pathology—in fact, if not in name. No specific designation was attached to the office at that time, just thirty years ago.

In the same year the sanitation of the Army in India, which had hitherto been controlled by the Quartermaster General's Branch, was transferred to the Medical Branch.

In the meantime a recommendation had been made—again under the pressure of enteric deaths—that, as an experimental measure, three specially qualified sanitary officers should be employed, with their headquarters at Lucknow, Rawalpindi, and Umballa, "whose sole duty would be to investigate fully the causes of disease and give practical advice in sanitary matters."

This proposal was sanctioned in January, 1898, under the following conditions:—

(1) That there should be no increase in the cadre of the Army Medical Staff;

(2) That one of the appointments be held in abeyance for the period that Davies was attached to the office of the P.M.O. in India;

(3) That the appointments were to be reserved for the R.A.M.C., "because in the I.M.S. (then regimental) there is only one officer for each appointment, and it is not possible to employ officers on extraneous duties without an increase to the cadre."

"The object aimed at is chiefly to combat diseases which almost exclusively attack British soldiers . . . . it is desirable that the officers required should, as a rule, be taken from the British Service. . . . The sanitary officer should be subordinate to the P.M.O. of his district."

The appointments took effect from April 1, 1898, "one being held in abeyance during the employment of Major Davies on special bacteriological investigations."

The organization in 1898 was therefore as follows:—

At Army Headquarters (from January 1, 1898).—A specialist for bacteriological investigations in cases of severe outbreaks of enteric fever, Major A. M. Davies, R.A.M.C.

District Sanitary Officers (2) (from April 1, 1898).—Rawalpindi District (Pindi): Major R. H. Firth, R.A.M.C.; Oudh District (Lucknow): Major J. R. Forrest, R.A.M.C.

During the first nine months of his appointment Major Davies carried out the following investigations—

(1) In January and February he made an exhaustive investigation into the sanitary condition of Mhow, and a bacteriological examination of the potable water, aerated water and milk supplies of the cantonment.

(2) In March similar duties were conducted at Rangoon.

(3) In April a bacteriological examination was made of the proposed water-supply from four separate sources for Dharmsala.

(4) In May a similar examination was made of the proposed water-supplies for the stations of Sialkot, Murree and Attock.

(5) In June, an exhaustive inquiry was made into the cause of last year's epidemic of enteric fever at Cherat, combined with a sanitary investigation of the whole station and a bacteriological examination of the water and milk supplies; also a bacteriological examination of the water supply of Nowshera.

(6) From July to October he was employed in continued bacteriological work and in compiling reports on the last six named stations; also in making, at the request of the Government of India, a special bacteriological examination of the various descriptions of the "Maillie" filter.

Major Davies' appointment was extended for a further period of one year "on special sanitary investigations and bacteriological work in cantonments."

In September, 1899, a further extension was applied for, the following additional work having been carried out:—

(7) *Quetta.*—Sanitary survey made, sources of the several water supplies visited, and a bacteriological examination made of water, milk, aerated waters and air samples.

(8) *Poona.*—Similar investigations conducted.

(9) *Kirkee.*—Similar investigations conducted.

(10) *Bellary.*—Bacteriological examination made of the proposed sources of water supply.

(11) *Secunderabad.*—Inspection of the existing and proposed sources of water-supply, bacteriological examination being made in each case.

(12) *Ahmednagar.*—Sanitary survey made, sources of the several water supplies inspected and bacteriological examinations made of each sample as well as of milk and aerated waters.

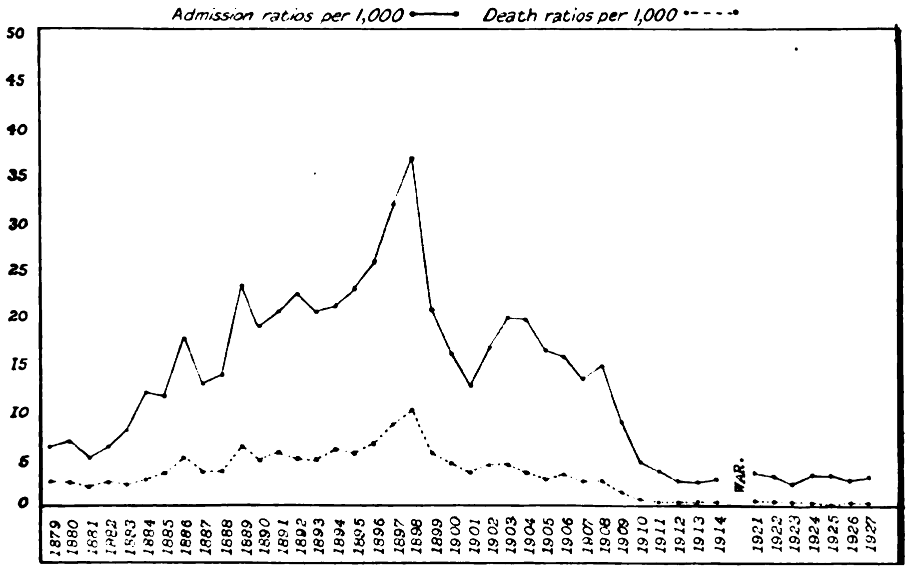
(13) *Umballa.*—Thorough investigation of the sources and distribution of the water-supply, making a large number of bacteriological examinations, in the course of which an organism was detected which greatly resembled the bacillus of enteric fever.

(14) *Aden.*—Sanitary survey and bacteriological examination of the several sources of water and other supplies.

(15) *Simla.*—Bacteriological testing of Pasteur-Maillie filters and examination of Aymard's milk sterilizer and of Ligner's disinfecting apparatus.

ENTERIC FEVER — BRITISH TROOPS IN INDIA

1879 - 1927.



(16) During Major Davies's absence on privilege leave, his duties were conducted by Major D. O'Sullivan, R.A.M.C., and this officer conducted a bacteriological examination of the Nari River.

The first reports of the two district sanitary officers, submitted in April, 1899, are full of interest.

While both covered vast tracts of country and carried out an enormous amount of work, it is interesting to note that one was chiefly concerned in making important bacteriological discoveries in connection with enteric fever, while the other devoted himself more to elaborate and detailed inspections of the sanitary conditions existing at the time.

Both fields were practically virgin soil.

No bacteriological apparatus was available to August, 1898. When it arrived there was no laboratory to put it in. Major Firth writes: "The work I have had to do has been entirely personal work. The only help

sanctioned is a chaprassi, an unskilled man of all work, who helps to clean up. All my culture media, etc., have to be made by me personally."

And a year later, "The heat in my laboratory at Lucknow is so intense that during the hot weather I had to start work at 4.30 am., and even then the temperature was over 90° F. In addition to this, one had to bear with the vexation of cultures and media continually getting contaminated owing to dust and dirt blowing through badly-fitting windows and doors."

It is astonishing to find that, although these officers were specially appointed by Government to deal with a grave emergency, their reports disclose not only the sanitary conditions that prevailed, but also the fact that in some stations their recommendations were studiously ignored. "My opinion was overruled . . . no notice was taken of my report . . ."

In most cases, however, action was taken, and it is easy to read in the reports the excellent results of their pioneer work. Their reports were forwarded to the Secretary of State.

In July, 1899—after the enteric débâcle of 1898—it was proposed "that the source of every proposed water-supply be examined bacteriologically by a specialist, and that, as time admits, a similar examination may be undertaken of every water supply in India." It was considered impossible for Major Davies to undertake this single-handed. It was also considered impracticable that the two special district sanitary officers should be "removed from their legitimate duties for this purpose."

The P.M.O. India therefore recommended that in place of the existing arrangement there should be a special sanitary officer (expert) at Army Headquarters, and one in each of the four Commands.

"As these officers' headquarters will be in the plains, they will each require the services of a clerk and a small office establishment, stationery, &c. A properly fitted laboratory will be required for each officer. The apparatus for three of these has already been supplied. If a suitable Government building is not available, one will have to be built near the station hospital. Each sanitary officer will require the services of a native laboratory assistant."

"As it is hoped that the establishment of these laboratories and the above extension of the sanitary scheme will make the treatment of rabies possible in strict accordance with Pasteur's principles, and will thus do away with the necessity of sending all soldiers bitten by mad dogs to Paris, and as they will enable us to make in India our own anti-serum without appreciable extra expense to the State (cost of materials only), the scheme should, apart from other considerations, recommend itself for favourable consideration."

"The initial expenditure will be about £200 as follows:—

Apparatus for 2 laboratories[1]	£60
Apparatus for 22 districts at £5 each	110
Miscellaneous	30
Total	£200"

[1] This does not include 2 microscopes which will cost £18 each = £36.

It was part of the scheme to associate with each command sanitary officer one of the medical officers from the station hospital, who would be relieved of part of his ordinary duties for the purpose. Such officers would be eligible to fill vacancies in the sanitary staff, and would be of great value as sanitary experts on field service.

The command sanitary officers were also "to supervise the district laboratories, direct the efforts of the officers in charge, and encourage the development of bacteriological research as much as possible" . . . "The constant consideration of all measures calculated to improve the health of the troops, which has been rendered more than ever necessary of late years *by the alarming and destructive prevalence of enteric fever,* indicates that no provision, however complete, will be effectual without incessant watchful supervision over the sanitary conditions of the British soldiers' surroundings in India."

In May, 1900, the appointment of a sanitary officer at the headquarters of each of the four commands was sanctioned, but not that of a sanitary officer at Army headquarters.

Major Davies' appointment was, however, extended from year to year, and in September, 1901, the appointment of a sanitary officer at Army headquarters was finally sanctioned.

The organization which gradually evolved in 1900 and 1901, and became fully established in 1902, was therefore :—

At Army Headquarters.—Sanitary Officer : Major McGill (from January 2, 1901).

LABORATORY.

Punjab Command.	*Bengal Command.*	*Bombay Command.*	*Madras Command.*
Sanitary Officer.	Sanitary Officer.	Sanitary Officer.	Sanitary Officer.
Major J. C. Weir, from October 1, 1900.	Major L. P. Mumby, from October 1, 1900.	Major C. R. Elliot, from January 1, 1901.	——— from January 4, 1902.
Laboratory.	Laboratory.	Laboratory.	Laboratory.

Note.—There was also at the headquarters station of each of twenty-two districts a small clinical laboratory in charge of an officer doing duty at the station hospital. These were called "district laboratories."

In 1902 the command bacteriological laboratories at Lucknow and Secunderabad were transferred to Naini Tal and Wellington respectively, "as bacteriological work cannot efficiently be carried out in such hot stations."

At the same time the small "district laboratory" authorized for Wellington was established instead at Secunderabad, and that for Mandalay district was established at Maymyo.

Soon afterwards "districts" were abolished, and "divisions" and "brigades" took their place.

In 1905 "specialist" appointments were introduced into India, 105 being created altogether. Of these, 44 were in "prevention of disease."

Appointment	Special branch	Distribution	Number of each class
Prevention of disease	(*a*) Public Health .. (*b*) Parasitology including bacteriology	2 to each laboratory established at the headquarters stations of divisions or brigades	44

On June 1, 1907, the "commands" were abolished, and India was divided into a northern army and a southern army, the whole comprising nine divisions and Burma. The command sanitary officers were abolished and a sanitary officer was appointed to each division, i.e., ten altogether, in addition to the sanitary officer at Army headquarters.

The twenty-two district laboratories were reclassified as "divisional" and "brigade" laboratories.

The Standing Committee on Enteric Fever recommended that a laboratory should be established at the headquarters of each division and brigade, and the P.M.O. India considered these necessary "for the investigation not only of enteric fever, but of malaria, kala-azar, dysentery, liver abscess, and many other of the diseases most important in the Army."

Ten of the existing laboratories were to be placed under the ten divisional sanitary officers.

Thirteen additional (clinical) laboratories were to be established, making altogether ten divisional and twenty-eight brigade laboratories. Where accommodation was not already available for the new laboratories, two rooms were to be provided, one 20 feet by 15 feet and one 10 feet by 10 feet.

A scale of fixtures and furniture and a scale of equipment were drawn up for each laboratory.

A ward-servant of the Army Hospital Corps was to be detached for duty as laboratory attendant at each laboratory.

These proposals were strongly supported by Lord Kitchener, then Commander-in-Chief, and were eventually sanctioned with effect from April 1, 1909.

The organization at that time was therefore :—

At Army Headquarters.— Sanitary Officer.

At the Headquarters of each Division (10).—Sanitary officer.

Divisional Laboratories ("for hygiene as well as for clinical investigation") (10).—Peshawar, Rawalpindi, Lahore Cantonment, Quetta, Mhow, Poona, Meerut, Lucknow (and Naini Tal), Wellington, Maymyo.

Brigade Laboratories ("for clinical work") (28).—Kohat, Bannu, D.I. Khan, Nowshera, Abbottabad, Jhelum, Sialkot, Jullundur, Ferozepore,

Ambala, Dehra Dun, Bareilly, Fyzabad, Allahabad, Calcutta, Shillong, Karachi, Nasirabad, Jubbulpore, Kamptee, Ahmednagar, Colaba, Belgaum, Secunderabad, Madras, Bangalore, Rangoon, Aden.

Personnel.—Officer in charge, laboratory attendant (ward servant of the A.H.C.)

Accommodation.—Two rooms; one 20 feet by 15 feet, one 10 feet by 10 feet.

Fixtures.—Glazed fire-clay sink; triple taps with two side jets for rubber attachments; microscope bench; chemical bench for blow-pipe work with three drawers; bench for incubator; shelves.

Furniture.—One almirah (cupboard); one writing table; two cane-bottomed chairs; two stools.

Equipment.—Incubator, sterilizers, microtome, microscope, &c.

A small annual allowance was also allotted to each laboratory for upkeep of equipment and for petty expenses.

The brigade laboratories were each in charge of an officer of the station hospital called "specialist in the prevention of disease."

In April, 1908, an enteric fever convalescent depot was established at Naini Tal, with a bacteriological laboratory for the detection of "carriers." In 1909, 345 enteric convalescents passed through the depot and seven "carriers" were detected.

The officer in charge of the enteric laboratory was Major (now Major-General) D. Harvey, whose pioneer work in the bacteriology of the enteric group of fevers is well known.

In June, 1909, an enteric fever convalescent depot with laboratory was opened at Wellington, for the South of India. In the first six months sixty-four convalescents were examined and three "carriers" were detected.

Anti-enteric inoculation was by this time well established. A census in December, 1909, showed that 43,566 of the British troops were protected by inoculation.

In 1909 enteric admissions fell to 639 and enteric deaths to 113—a very marked improvement on the figures of 1898.

In 1912 the designation of the "P.M.O. His Majesty's Forces in India" was changed to "Director of Medical Services, India."

On December 1, 1912, as part of an economy campaign, the appointment of A.D.M.S. (Sanitary) at Army headquarters was abolished, the last-holder being Colonel (now Sir Robert) Firth.

During the war the appointment of A.D.M.S. (Sanitary) at Army headquarters was re-established in 1916. In 1921 the designation was changed to "Director of Hygiene and Pathology."

The four commands (northern, southern, eastern and western) were reconstituted in 1921, each consisting of a number of districts, with Burma as an independent district.

Each of the four commands and each of the fourteen districts had a

Hygiene and Pathology Organization of the Army in India in 1924.

At Army Headquarters.

Director of Hygiene and Pathology.

Northern Command.

D.A.D.M.S (San.).

Peshawar District.	Rawalpindi District.	Lahore District	Kohat District.	Waziristan District.
--	—	D.A.D.M.S. (San.).	D.A.D.M.S. San.).	D.A.D.M.S. (San.).

3 District and 10 Brigade Laboratories.

Eastern Command.

D.A.D.M.S. (San.).

U.P. District.	Delhi Indt. Bde. Area.	Allahabad Indt. Bde. Area.	P. & A. District.
D.A.D.M.S. (San.).	—	—	D.A.D.M.S. (San.).

2 District and 8 Brigade Laboratories.

Western Command.

D.A.D.M.S. (San.).

Baluchistan District.	Sind-Rajputana District.
D.A.D.M.S (San.).	—

1 District and 2 Brigade Laboratories.

Southern Command.

D.A.D.M.S. (San.).

Bombay District.	Central Provinces District.	Poona District.	Madras District.
D.A.D.M.S. (San.).	D.A.D.M.S. (San.).	—	D.A.D.M.S. (San.).

3 District and 8 Brigade Laboratories.

Burma District.

D.A.D.M.S. (San.).

1 District and 1 Brigade Laboratory

Aden Brigade.

1 Brigade Laboratory

Enteric Fever Convalescent Depots (2) at Naini Tal and Wellington.

D.A.D.M.S. (Sanitary). District laboratories were in charge of the district D.A.D.M.S. (Sanitary).

In 1923, under the pressure of economy (so-called), four of the district appointments were abolished.

In 1924 the organization was as shown in the scheme on p. 418.

The Reorganization of 1925.

In the autumn of 1924 the whole position was reviewed. A scheme was drawn up to introduce into India the system that had been adopted in the United Kingdom and Colonies in 1919, viz., to separate hygiene from pathology and hand over the district laboratories to specially qualified pathologists, who would also act as advisers to A.Ds.M.S. But this required money, and the purse-strings were tightly held. On reckoning up the resources available it was found that, by abolishing some of the smaller laboratories that were near to others, and by certain other rearrangements, the scheme could be described as having "no financial effect." Difficulties now began to melt away, and on April 1, 1925, a deputy assistant director of pathology was appointed to each of the fourteen districts with charge of the district laboratory.

The confusion which had crept into the nomenclature of laboratories was at the same time cleared away. Only those at the headquarters of districts (14) were called "district laboratories." All others became brigade laboratories. The officer in charge of a brigade laboratory was designated as such and dropped the ill-fitting title of "specialist in the prevention of disease."

The four command D.A.Ds.M.S. (San.) became "assistant directors of hygiene and pathology." The designation of the district D.A.D.M.S. (San.), now relieved of laboratory work, was changed to "deputy assistant director of hygiene."

The qualifications laid down for these appointments are as follows:—

A.D. of H. and P. Command: An officer who holds the D.P.H. is qualified as a specialist in hygiene and with previous experience as an A.D.P. or D.A.D.P.

D.A.D.H. District: An officer who holds a specialist certificate in hygiene (R.A.M. College), or an equivalent qualification.

D.A.D.P. District: An officer who holds a specialist certificate in pathology (R.A.M. College) or an equivalent qualification (i.e., holding a D.P.H. or D.T.M. and H., *plus*—in either case—at least three months' training in a district laboratory).

Officer in charge brigade Laboratory: An officer who holds a specialist certificate in pathology (R.A.M. College) or a D.P.H. or D.T.M.

The Passing of the D.A.D.M.S. (San.).

There are some fortunate mortals whose lives flow smoothly like a placid river. Their place is known, their designation clear, their *métier* well defined.

Not so the ubiquitous D.A.D.M.S. (San.). In his day anti-malarial measures, water supplies, ration problems, epidemics, sanitary training, etc., competed with bacteriological diagnosis, microscopic work and serological analysis. Reports, returns, statistics and a thousand other things clamoured for their share of attention. From office to laboratory, from laboratory to barracks, from out-station to office, he rushed in a giddy whirl, reminding one of the old Scotsman's description of the busy young doctor; but that is another story!

Looked on by the G.O.C. as a glorified sanitary inspector, by the A.D.M.S. as a safeguard against "trouble," and by the assistant surgeon of the laboratory as one whose hurried signature transformed the laboratory boy's grotesque findings into an unimpeachable scientific report, the D.A.D.M.S. (San.) played his part nobly and well. He has gone the way of all men. R.I.P.

During the period since April, 1925, military laboratories in India have been greatly improved and developed.

Personnel.

Each district laboratory has now the following personnel:—

Officer in charge	1 (D.A.D.P. of the District)
Assistant surgeon	1
R.A.M.C. laboratory assistant	1 (1st class laboratories only)
Indian Hospital Corps ward servant, 1st or 2nd grade	1
Indian Hospital Corps sweeper	1

Brigade laboratories are staffed from the hospitals to which they are attached.

Accommodation.

Standard plans for laboratories were drawn up in 1926, and laboratories are gradually being brought up to these standards.

The principal district laboratory in each Command has now a general work-room, officers' room, office, sterilizing room, media room, washing-up room, glass and chemical room, biochemical room, weighing and filtering room, muffle-furnace and fume-cupboard room, dark room, store-room, waiting-room and animal house.

Furniture.

A generous scale of furniture sufficient for all purposes has been authorized in place of the cupboard, table, chairs and stools which have done duty since 1909.

Equipment.

An ample scale of equipment has recently been sanctioned for all laboratories. Most of this has already been supplied from special grants provided for the purpose.

In addition, the annual money allowance for equipment and petty supplies has been increased to Rs. 900 in the case of a Command and a first-class district laboratory, Rs. 565 for a second-class district laboratory and Rs. 365 for a brigade laboratory.

Training.

District laboratories now undertake the training of medical officers, assistant surgeons and sub-assistant surgeons in laboratory work. Assistant surgeons undergo a course of six months' training; sub-assistant surgeons have a twelve months' course.

The syllabus of training is a full and comprehensive one. Those who pass the final examination are noted as qualified for employment.

Reports.

Each assistant and deputy-assistant director of pathology prepares an annual report dealing with the whole of his area, along with a detailed report of the work done in each laboratory. Similarly each assistant and deputy-assistant director of hygiene submits annually a statistical and general report for his area, with a list of the more important works and improvements carried out during the year.

Libraries.

Small reference libraries of up-to-date books have been established in all hospitals and laboratories.

Clinical Side-rooms in Hospitals.

A clinical side-room has been provided in each British and Indian military hospital and supplied with microscope, stains, reagents and all necessary equipment.

Antirabic Treatment.

Prior to 1900, any person (military or civil) who was bitten by a rabid dog had to be sent to Paris for treatment. In that year a Pasteur institute was opened at Kasauli with Major Semple, R.A.M.C., as superintendent. Treatment now became available in India. The institute was maintained by private subscribers and local Governments, supplemented by an annual grant of Rs. 9,500 from the Government of India, which also provided the services of a medical officer and an assistant surgeon. In return for this assistance, the institute was to "undertake the treatment of civilians as well as soldiers."

There are now a number of Pasteur institutes in India.

In 1924, with a view to bringing treatment still nearer, military antirabic centres were opened at a few stations in Southern India, vaccine being obtained from the nearest Pasteur institute. This system has developed until there are now no less than thirteen military antirabic centres under the control of the deputy assistant directors of pathology.

Hygiene and Pathology Conference.

The first hygiene and pathology conference was held at Army headquarters, Simla, in February, 1927.

The conference was attended by the assistant directors of hygiene and pathology of the four commands and by a number of district deputy assistant directors of hygiene and of pathology. The conference lasted three days and discussed a large number of questions, *inter alia* the following :—

Statistics, malaria, cantonments, barracks, rations, sanitary training, recruiting, child welfare, laboratory organization and technique, clinical side-rooms, medical literature, antirabic treatment and research.

The First A.D.P.

In November, 1927 the appointment of assistant director of pathology, Southern Command, was created, with a command laboratory at Poona.

Military Food Laboratory.

The military food laboratory, established as a temporary measure during the war for the examination of foodstuffs supplied to the troops, was placed on a permanent footing in 1927, and taken over from the Quartermaster-General's branch.

Enteric Laboratory, Kasauli.

In January, 1928, the enteric fever convalescent depot and laboratory were moved from Naini Tal to Kasauli, where a new roomy laboratory and up-to-date equipment have been provided.

The staff has been augmented and now consists of—

Officer in charge	1
Assistant surgeon	1
Laboratory assistants—	
Corporal, R.A.M.C.	1
Private, R.A.M.C.	1
Clerk	1
Carpenter	1
Ward-servant, I.H.C.	1
Ward-sweeper, I.H.C.	1
Attendants	2

This is now the only enteric laboratory in India, and deals with all convalescents from enteric fevers and "pyrexia of uncertain origin." This laboratory also prepares all standard agglutinating cultures and high-titre sera for enteric work in command, district and brigade laboratories. Subcultures of all enteric organisms isolated are sent to it for record.

The enteric laboratory (pathology) and the military food laboratory (hygiene) are now housed in the same building at Kasauli and are directly under, and within easy reach of the Medical Directorate at Simla. This arrangement possesses many advantages and considerable possibilities.

Venereal Diseases.

From the earliest times venereal diseases have constituted one of the most difficult problems of Army life in India.

Cloaked under the euphemistic title of "Enthetic Diseases," until 1868, and hidden in the "constitutional" and "systemic" groups for decades thereafter, venereal diseases have many times competed with malaria for first place as a cause of hospital admissions, and are easily the first supporter of the "average constantly sick," and the chief cause of hospital expenditure. The admission rate in 1925 was 72·1 per 1,000, compared with 69·6 in 1908.

In 1927 it was decided to absorb the control of venereal diseases into the new hygiene and pathology organization, to bring prevention under the wing of hygiene, and diagnosis and treatment within the ægis of pathology. In January, 1928, an assistant director of pathology was appointed at Army headquarters in place of a consultant dermatologist. In March, the central dermatological laboratory at Poona was closed, and Wassermann and allied work was taken over by the principal laboratory at the headquarters of each command.

Treatment remains, as before, in the hands of qualified specialists in dermatology.

Physiological Laboratory.

A small physiological laboratory has been opened for the investigation of problems connected with defensive chemical warfare.

The scope of the hygiene and pathology directorate, as developed in recent years, will best be described by an enumeration of the subjects dealt with.

Pathology.

Annual Reports—
- Assistant and Deputy Assistant Directors of Pathology.
- Medical Specialists.
- Surgical Specialists.

Army Forms, Pathology.

Bacteriology—
- Food supplies.
- General questions.
- Water.

Chemical Warfare—
- Physiological research.

Clinical Side-Rooms in Hospitals—
- Accommodation, Equipment. } Scale of.

Diagnosis—
- Changes.
- Methods of.

Enteric Fever Case Sheets.

Enteric Fever Laboratories.

Inoculation Technique.

Laboratories—
- Accommodation.
- Animals.
- Books.
- Equipment, apparatus and materials, scale of.
- Equipment allowance.
- Furniture.
- Mobile laboratories.

Laboratories (*continued*)—
- Personnel.
- Reports and returns.
- Technique.
- Training.

Medical Case Sheets.

Medical Literature—
- Articles for publication.
- Circulation of extracts.
- Libraries, hospital,
- Medical Directorate library.
- Periodicals, circulation of.

Rabies and Anti-Rabic Treatment.

Reports and returns.

Research—
- Accounts.
- Reports.
- Schemes.

Treatment—
- Methods of.

Vaccines and Sera—
- Control.
- Returns.

Venereal Diseases—
- Diagnosis.
- Treatment.
- Wassermann and allied tests.

HYGIENE.

Accommodation for Troops—
- In barracks, camps, transports, hospitals.
- Lighting, ventilation, drainage.
- Plans, approval of.
- Sites, approval of.
- Schedules of demands.

Annual Report on the Health of the Army.

Annual Reports—
- Assistant and Deputy Assistant Directors of Hygiene.

Anti-Malarial Measures—
- Cold storage.
- Fumigation.
- Mosquito-proofing of barracks.
- Mosquito nets.
- Propaganda.
- Schemes.

Army Forms, Hygiene.

Army Schools—
- Accommodation, lighting, furniture, etc.
- Physical examination of school children.
- Reports.

Cantonments—
- Health organization and reports.

Child Welfare—
- Organization of Centres.
- Propaganda.

Clothing and Equipment—
- Hygiene questions.

Communicable and Infectious Diseases—
- Epidemic and endemic.
- Disinfection and disinfestation.

Deficiency Diseases—
- Beri-beri.
- Scurvy.

Entomology.

Foodstuffs—
- Analysis.
- Values.
- Food-poisoning.

Health Statistics—
- A.F.I. 1220 (Hospital Record Card).
- Charts, graphs, histograms.
- Forms.
- Reports and returns.

Hospital Diets and Extras—
- Composition and food values.

Cooking, etc.

Hospital Record Cards.

Hygiene Laboratories.

(*Continued on p.* 430.)

Hygiene and Pathology Organization of the Army in India in 1928.

At Army Headquarters.

D. of H. & P.

A.D.P. — D.A.D.H.

Enteric Laboratory.
Military Food Laboratory.

Malaria Treatment Centre.
Physiological Laboratory.

Northern Command.

A.D.H. & P.

Peshawar District.	Rawalpindi District.	Lahore District.	Waziristan District.	Kohat District.
D.A.D.H. (also for Kohat).	D.A.D.H. (also for Waziristan).	D.A.D.H.	—	—
D.A.D.P.	D.A.D.P.	D.A.D.P.	D.A.D.P.	D.A.D.P.

5 district and 3 brigade laboratories.

Eastern Command.

A.D.H. & P.

Meerut District.	Lucknow District.	P. & A. District.	Delhi Brigade.
D.A.D.H. (also for Delhi).	D.A.D.H. (also for P. & A.).	—	—
D.A.D.P.	D.A.D.P.	D.A.D.P.	

3 district and 4 brigade laboratories.

Western Command.

A.D.H. & P.

Baluchistan District.	Sind Brigade.	Zhob Brigade.
D.A.D.H.		
D.A.D.P.		

1 district and 1 brigade laboratory.

Southern Command.

A.D.H. — A.D.P.

C.P. District.	Deccan District.	Bombay District.	Madras District.	Poona Brigade.
—	D.A.D.H.	D.A.D.H.	D.A.D.H.	(A.D.H., Southern Command.)
D.A.D.P.	D.A.D.P.	D.A.D.P.	D.A.D.P.	(A.D.P., Southern Command.)

1 Command, 4 district and 3 brigade laboratories.

Burma District.

—

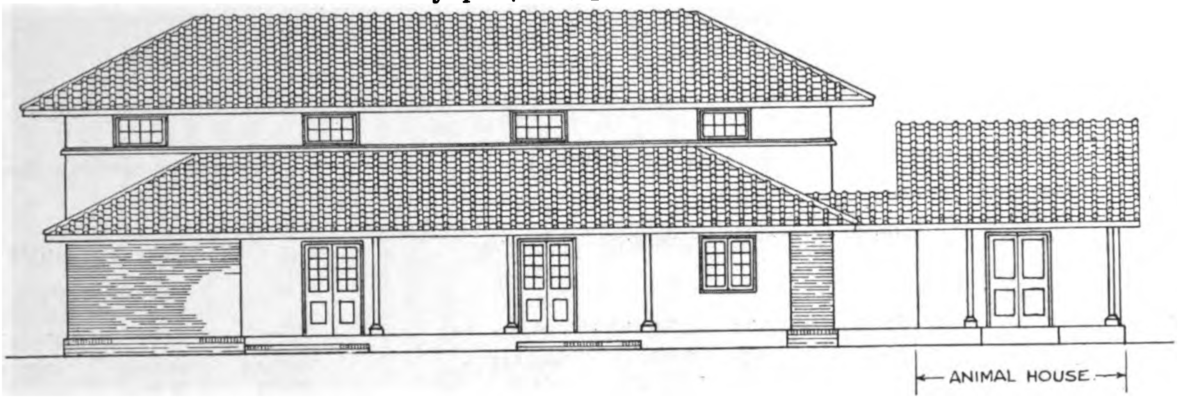
D.A.D.P.

1 district laboratory and 1 brigade laboratory.

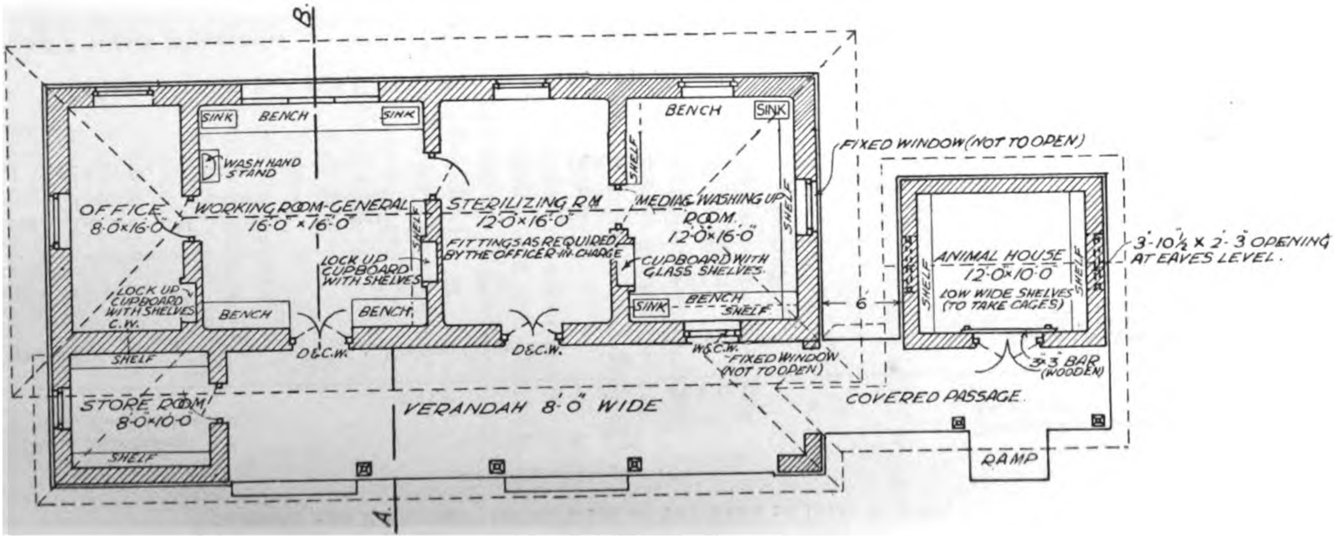
Summary.

D. of H. & P. ..	1
A.D.H. & P. ..	3
A.D.H.	1
A.D.P.	2
D.A.D.H. ..	10
D.A.D.P. ..	14
	31

BRIGADE LABORATORIES—A CLASS, AT KARACHI, DEHRA-DUN, JUBBULPORE AND JHANSI. *In accordance with the Barrack Synopsis (India), para. 62 A (c).*



FRONT ELEVATION

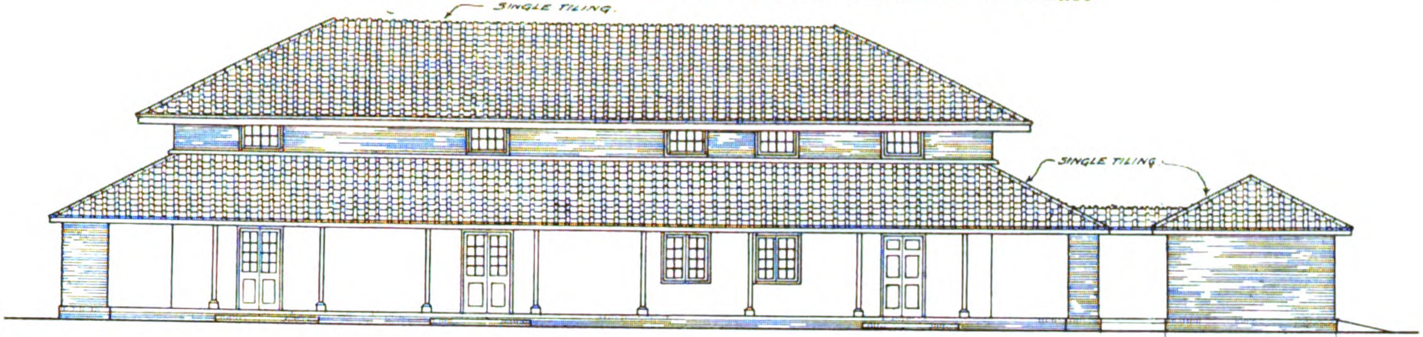


PLAN

SCALE.

FEET 10 0 10' 20' 30' 40' 50' 60' 70' 80 FEET.

DISTRICT LABORATORIES—EXCEPT QUETTA, RAWALPINDI AND MEERUT



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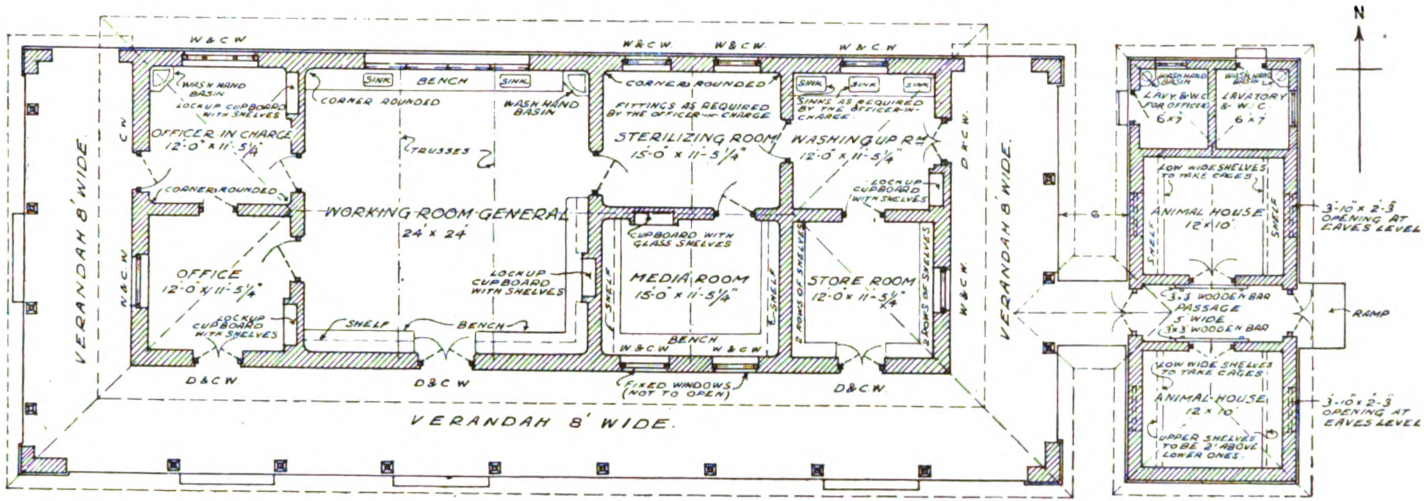


PLAN

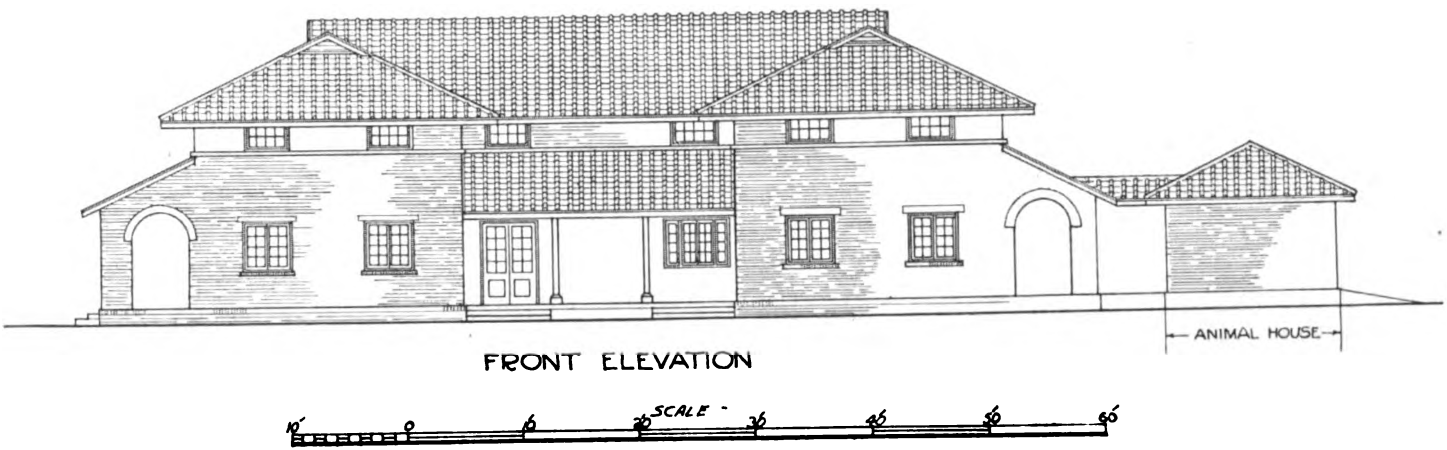
SCALE.

FEET. 10' 0' 10' 20' 30' 40' 50' 60' 70' 80 FEET.

SOUTHERN COMMAND LABORATORY AT POONA.

DISTRICT LABORATORIES AT QUETTA, RAWALPINDI AND MEERUT.

In accordance with the Barrack Synopsis (India), para. 62 A (a).



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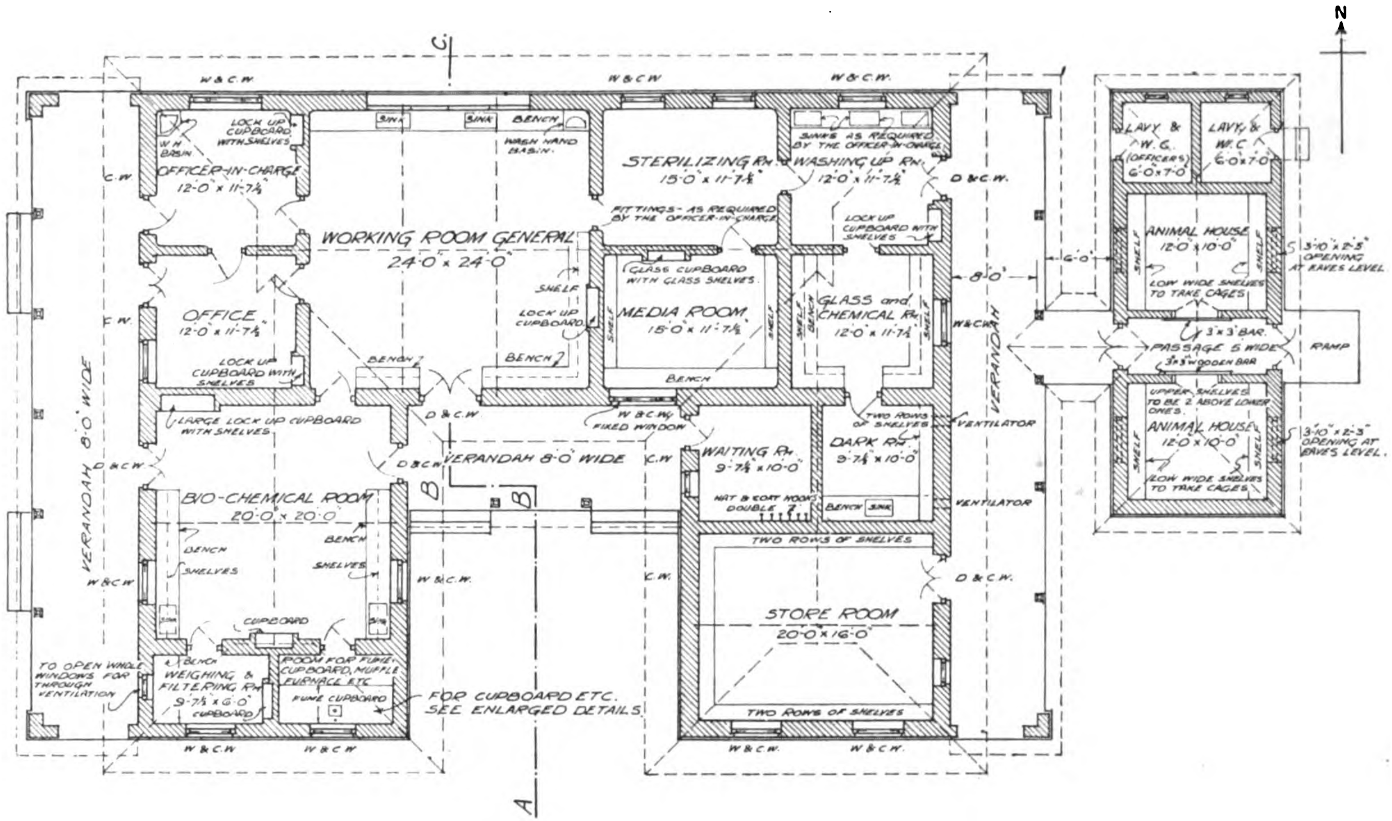

N
OFFICER-IN-CHARGE
12'-0" x 11'-7½"
LOCK UP CUPBOARD WITH SHELVES
W.H. BASIN
WORKING ROOM GENERAL
24'-0" x 24'-0"
SINK
BENCH
WASH HAND BASIN
STERILIZING RM.
15'-0" x 11'-7½"
WASHING UP RM.
12'-0" x 11'-7½"
SINKS AS REQUIRED BY THE OFFICER-IN-CHARGE
FITTINGS - AS REQUIRED BY THE OFFICER-IN-CHARGE
LOCK UP CUPBOARD WITH SHELVES
GLASS CUPBOARD WITH GLASS SHELVES
MEDIA ROOM
15'-0" x 11'-7½"
GLASS and CHEMICAL RM.
12'-0" x 11'-7½"
SHELF
LOCK UP CUPBOARD
OFFICE
12'-0" x 11'-7½"
LOCK UP CUPBOARD WITH SHELVES
LARGE LOCK UP CUPBOARD WITH SHELVES
W & C.W.
C.W.
D & C.W.
W & C.W. FIXED WINDOW
WAITING RM.
9'-7½" x 10'-0"
HAT & COAT HOOKS DOUBLE
DARK RM.
9'-7½" x 10'-0"
TWO ROWS OF SHELVES
VENTILATOR
VERANDAH 8'-0" WIDE
VERANDAH
8'-0"
6'-0"
BIO-CHEMICAL ROOM
20'-0" x 20'-0"
BENCH
SHELVES
CUPBOARD
WEIGHING & FILTERING RM.
9'-7½" x 6'-0"
ROOM FOR FUME CUPBOARD, MUFFLE FURNACE ETC.
FUME CUPBOARD
TO OPEN WHOLE WINDOWS FOR THROUGH VENTILATION
FOR CUPBOARD ETC. SEE ENLARGED DETAILS
STORE ROOM
20'-0" x 16'-0"
TWO ROWS OF SHELVES
LAVY. & W.C. (OFFICERS)
6'-0" x 7'-0"
LAVY. & W.C.
6'-0" x 7'-0"
ANIMAL HOUSE
12'-0" x 10'-0"
LOW WIDE SHELVES TO TAKE CAGES
UPPER SHELVES TO BE 2' ABOVE LOWER ONES.
3'-0" x 2'-3" OPENING AT EAVES LEVEL
3" x 3" BAR
PASSAGE 5' WIDE
3" x 3" WOODEN BAR
RAMP
A
B
C

PLAN

Inoculation Returns.
Instruction in Prevention of Disease—
  Sanitary demonstration areas.
  Training of unit sanitary personnel.
Invaliding, British Personnel.
Military Food Laboratory—
  Ghi-testing Branch.
Movements of Troops.
Physical Training.
Rations—
  Composition and food values.
  Cooking.
  Quality.
  Scales.
  Storage.
Recruiting—
  Physical examination of recruits
Reports and Returns.
Sanitary Sections.
Tour Notes—
  Hygiene questions.
Units and Drafts—
  Physical fitness.
Vaccination—
  Returns.
  Technique.
Water Supplies—
  Distribution, purification.
  Schemes.
  Source and storage.
  Water analysis.

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Simla Records.
Army Instructions, India.

(*To be continued.*)

COMBATANT AND NON-COMBATANT: A MEDICAL LECTURE.[1]

By Major A. C. AMY, D.S.O.
Royal Army Medical Corps.

I.—Co-operation.

It has fallen to my lot to deliver many lectures on divers medical subjects both to civil and military audiences.

At the beginning of a lecture I always sense an atmosphere of expectant curiosity. The layman, civil or military, looks on the doctor as a sort of conjurer or mystery man who, at each performance, is expected to leave out the old tricks and show a few new ones.

From the lecturer's standpoint this is disconcerting; it is not always easy to live up to expectations.

Hitherto, I have demonstrated my sleight-of-hand and tried to teach you its technique; but on this occasion I propose that we exchange rôles; you shall provide the captions which I will endeavour to illustrate with the aid of Medicine.

For us the task should not be unduly difficult. Whereas the civilian doctor is but a lone individual in a universe, the Service medical officer is a *brother* officer within a small and strictly limited circle.

That is a great asset: it betokens co-operation.

Only by effective co-operation can the component parts of any force develop fully their inherent power.

This co-operation, which can be ensured only by unity of control, is an essential factor of success; all leaders down to those of the smallest units must endeavour to apply at all stages of a fight this principle of mutual support. (F.S.R. II, 2 (2) (viii).)

Indeed, co-operation is imposed on us.

Although King's Regulations and Field Service Regulations lay the burden of advisory responsibility for sanitation and hygiene on my shoulders, that of executive responsibility is laid on yours.

Besides, the exigencies of the Service have made you more or less familiar with woundings, disease and death, both at home and abroad.

Your first-hand acquaintance with these matters may be superficial and somewhat unsound—and certainly your ideas on medical ethics are simply shocking; nevertheless, the scope and quality of your knowledge is such that you cannot be fooled.

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[1] Prepared for delivery at the Senior Officers' School, Sheerness, i.e., to an audience of combatant officers.

Critical medical readers may find some of the remarks rather far fetched; but it should be remembered that a deliberate attempt was made to present the subject in a novel fashion, with a view to arousing attention and stimulating interest.—A.C.A.

A civil audience is detached, gullible and receptive.

A military audience is interested, knowledgeable and critical.

But the basis of co-operation—mutual goodwill, understanding and sympathy—does not, and cannot, rest on Regulations alone. It has a far deeper and stronger foundation. If we follow the excellent advice contained in F.S.R. II, 3 (3): *To make sound deductions from experience, reflection and comparison are necessary*—we come to an important, an indisputable, a definite conclusion. It is this: That co-operation must be the easiest thing in the world for the reason that the so-called non-combatant is, in truth, a combatant. Thus :—

Factor	Combatant	Non-combatant
Training—1st	R.M.C. and R.M.A.	Medical School and University
2nd	S.O.S. and Staff College	R.A.M. College
Object—1st ..	*War is the ultimate resource of policy, and every nation must be ready, in the last instance, to protect its vital interests by force of arms unless it is prepared to surrender them to an enemy without a blow* (F.S.R. "Intro." 1)	Prevention of injury and disease
2nd..	*War can be brought to a successful conclusion only by the defeat of the enemy's armed forces and the destruction of his powers of resistance* (F.S.R. I, 1)	Cure of injury and disease
Enemy ..	Man, corporate and individual	Disease, decay and dissolution
Time	Intermittent and uncertain	Constant and certain
Terrain ..	Comparatively limited	Without limits

Nor is that the end of the story. To make the case for co-operation doubly, trebly sure, you may read F.S.R. I, 3 (2) and (42). *War is an art and not an exact science.*

In my profession the formula is "The Science and Art of Medicine."

We are all in pursuit of art; but whereas you practise an inexact science, I practise an exact one.

Be not deceived.

The science of medicine is exact; but it is of such vast extent and great complexity that exactitude in its practice is beyond human potentiality. Even Moses, the greatest of all military sanitarians, made mistakes.

12. *Thou shalt have a place also without the camp, whither thou shalt go forth abroad;*

13. *And thou shalt have a paddle upon thy weapon; and it shall be, when thou wilt ease thyself abroad, thou shalt dig therewith, and shalt turn back and cover that which cometh from thee.* (Deuteronomy, xxiii.)

Shallow trenching in the East.

After that, Napoleon may be forgiven a few of his worst blunders.

Finally: *Over-concealment tends to prevent intelligent co-operation.* (F.S.R. II, 42.)

The medical profession is a "close corporation."

This ancient truism is not weakened by the fact that, nowadays, "our medical correspondent" is a regular contributor to the columns of the public press. The initiated need only glance at these columns to realize how few secrets our medical correspondent is giving away; how absurd are his pretensions to educate the masses; how scared he is of the saying that "A little knowledge is a dangerous thing." To this there are exceptions, but they are few and far between, and hard for the layman to distinguish.

In the Services it has always been different. Your medical officers have tried to teach you everything necessary in the most open and sound manner possible. It is to their advantage, to your advantage and to the advantage of the Service that ALL should be well and fully instructed in matters which are capable of influencing the course of war to victory—or to defeat.

The very nature of things forbids us to have any sympathy with the close corporation idea.

II.—Information and Reconnaissance.

Detailed and timely information about the enemy . . . . is a necessary factor of success in war.—(F.S.R. II, 33 (1).)

Time spent in reconnaissance is rarely wasted.—(F.S.R. II, 87.)

Before the recruit is attested he is examined by a medical officer.

When he arrives at your depot he is examined again by another medical officer.

While undergoing training he is inspected by the deputy assistant director of hygiene for the area, and often also by the assistant director of hygiene for the command.

Why all this fuss and bother?

To obtain detailed and timely information about the enemy.

Time and energy in reconnaissance are rarely wasted.

It is not generally known that sixty-four per cent of those who present themselves for enlistment are rejected at the first examination on medical grounds. Of the remaining thirty-six per cent, half are rejected on military grounds. Thus, only eighteen per cent of the aspirants are finally accepted.

The application of the principles contained in the Regulations quoted above to recruiting procedure is comparatively recent; but good results have already been achieved, thus :—

Year	Ratio of rejections and discharges per 100 examined. On first examination.	Unfit within six months of enlistment.
1922-23	37·7	4·0
1923-24	36·4	3·0

These decreases are of importance when it is remembered that, in 1923-24, over 57,000 candidates for enlistment came forward.

28

The effects of timely information and reconnaissance on general physique, health and invaliding cannot be over-estimated.

III.—Protection.

The security of a force is the first responsibility of its commander.—(F.S.R. II, 43 (1).)

It is the duty of every commander to make the necessary arrangements for the protection of his command from hostile aircraft.—(F.S.R. II, 64 (1).)

Firstly, I would remind you of a case in which medical security and protection were denied to a force with results which can be described as deplorable.

Secondly, I would draw your attention to a recent medical extension of the above Regulations: an extension which, so far, has had the happiest outcome and which is certain to exercise great and beneficial effects in the future.

(1) Before the final advance in Palestine, marching loads were reduced as much as possible.

In conformity with this all mosquito nets were returned to store.

This meant that the troops were deprived of security, and of protection, against anopheline aircraft.

Detailed and timely information about the enemy—malaria—was available, reliable and exact. It was to the effect that the Turkish army was absolutely riddled with a most malign form of this disease. And yet F.S.R. II, 33 (1) and 43 (1) were defied.

The results were felt throughout the whole force. As an example, the plight of the Desert Mounted Corps may be described. At this period the Corps consisted of the Australian Mounted Division and the 4th and 5th Cavalry Divisions. Up to September 25 these troops had a good bill of health.

Damascus was occupied on October 1. Its hospitals were full of Turkish sick. In the barracks alone there were 900 patients in a miserable condition.

Malignant malaria and influenza broke out amongst the British troops in and around Damascus; and with such severity that, by October 6, the medical situation was serious; all medical units were overcrowded, overworked and undermanned. Sickness took toll of the medical and nursing staffs, and there was a great shortage of medical equipment and supplies.

Admissions to field ambulances alone were as follows:—

Week ending	Sick	Wounded
September 21	825	19
,, 28	1,192	153
October 5	1,856	72
,, 12	2,748	7
,, 19	2,029	5
,, 26	886	38
November 2	772	4
,, 9	519	..
,, 16	496	1
	11,323	299

The high sickness rates were due chiefly to the operations in the very malarious Esdraelon Valley, as well as to influenza. Malaria began after the enemy areas had been entered and the incubation period had elapsed. The rush of sick then was overwhelming.

Had it not been for the glamour of a great and glorious victory and for the momentous happenings in other theatres of war, there were, in these figures, the makings of another unsavoury "medical scandal."

(2) Autumnal malaria admission-rate per 1,000 of strength of British troops:—

Year	Lahore	Amritsar
1923	850	710
1924	483	747
1925	569	608
1926	182	171

Statistics now available show that, in 1926, the malarial epidemicity in the Lahore-Amritsar area was *above* the normal.

How, then, are the remarkable figures in the table to be explained?

Up to 1925, the barracks in Lahore and Amritsar were like all barracks in India, not protected against the entry of mosquitoes.

In 1926, these barracks were made mosquito-proof.

It is yet too soon to say that this is the cause of the great drop in malaria incidence; many factors have to be considered and weighed in evidence, and the experiences of one season only are not enough. But how suggestive!

The Americans are firm believers in this form of prophylaxis—the proofing of buildings—and are a hundred years ahead of us in practice.

Did they not build a great canal through a region which used to be a malarial hell?

If their work counts for anything, and if the Lahore-Amritsar experiment fulfils its first promise, then the expenditure of a certain amount of money will open a new health era for our troops in India.

This expenditure *must* be reckoned as small when weighed in the balance with sickness, invalidings and deaths.

In reading Field Service Regulations we are apt, at times, to remark with a smile: "Oh, but this is a mere platitude!"

In face of the two occurrences which we have just been considering—one of error or neglect, and the other of logical compliance—we should hesitate before indulging in that remark.

IV.—The Approach March.

We need not discuss a matter notorious to all the world, but may state without fear of dispute that the conditions of modern war demand that the marching powers and endurance of the soldier must not be lessened by unnecessary weight, or by a defective mode of carrying the weight.

Ceteris paribus, the army that is least weighted, and that can move with the greatest rapidity must have the advantage. (Report No. II of a W.O. Committee.)

These wise words were written in 1867; and yet, if ever there was a call for increased mobility, surely it is sounding *now*.

Of course the problem is a general staff one from first to last. However, in between, let us co-operate, for it is a problem on which medical officers have expended much time, thought and work. The exactitude of our science has furnished us with strong feelings, definite ideas and useful suggestions regarding this matter.

The subject has a long history and an interesting literature,[1] too long and interesting to be dealt with now.

What are the present facts?

On physiological grounds the load carried should never exceed a third of the body weight.

The average weight of the soldier is 135 pounds, so his load should never exceed 45 pounds.

In the South African War his load was 59 pounds.

In the Great War (1918) it was 80 pounds.

To-day it is 55 pounds 6¾ ounces.

Destructive criticism is a poor thing; here is my own plan[2] for reduction of the soldier's load: maximum weight, 42 pounds 9¾ ounces.

A word of warning: as soon as you reduce the load to 40 pounds, certain plausible individuals will attempt to foist on you a few new and imponderable trifles. Of that there is not the slightest doubt.

Well, repulse them.

Whenever such individuals engage in an offensive, remember that *infantry allotted to the defence of a locality is responsible for holding it at all costs.*[3]

Be of good heart, for an outraged and powerful medical service will be your close support.

V.—Contact and General Plan.

The commander who first comes to a decision as to his course of action and who gives effect to that decision without delay. . . . (F.S.R. II, 30 (1).)

Success in these initial combats will gain for a commander a general liberty of action. (F.S.R. II, 29 (1).)

These are arresting sentences.

Decide, diagnose—early.

Act on your decision, your diagnosis, without delay.

If you appreciate the situation rightly and promptly, and if you take appropriate measures to deal with it at once, you are assured of initial success.

Initial success in medicine, as in war, carries you far on the road to ultimate victory.

The recital strikes a personal note. It brings out more clearly than anything else the close resemblance between the soldier and the doctor.

---

[1] For example, see "The Load carried by the Soldier," by the late Major N. V. Lothian, M.C., R.A.M.C.; and Army Hygiene Advisory Committee's Report, No. 3 of 1923.

[2] Here reproduced as an Appendix.

[3] F.S.R., II, 93 (1).

While you are thinking of Marlborough, Nelson, Napoleon, I have in mind Jenner, Paget, Lister.

With you it is not merely a matter of rules, regulations and instructions; another element comes into play—intuition, genius, call it what you will.

With us it is not merely a matter of blood-slides, skiagrams and pulse-rates; another factor determines accuracy of diagnosis, appropriate treatment and speedy action; that factor we call the "Clinical Sense."

Think of Nelson's instant decisions and consequent actions. Were they born of lightning calculations in terms of men, guns, ships, winds and tides? Certainly not! In the same way, the man in whom you have "perfect confidence" does not depend upon his microscope, stethoscope and test tubes, for he possesses that rare and priceless quality, the clinical sense.

It is not a common gift. If your "Medical Officer in charge of effective troops" possesses it, stick to him.

VI.—Advancing by Bounds.

These tactical points should be gained in a series of bounds. (I.T. II, 28 (9).)

Many of you have to serve in the Far East. There you live in bungalows which are surrounded by servants' quarters and stables. You work in close association with native troops.

Plague is common; between 1896 and 1911, it caused over 7,000,000 deaths in India alone, and it is still rife. Rats abound everywhere, and they are infested with fleas.

Fleas can advance by a series of bounds in a way which staggers imagination. A flea is only about one-tenth of an inch in length, and yet a a human flea can bound vertically seven inches, and horizontally thirteen inches. That is equal to a jump of three hundred yards by a six-foot man.

Our infantry soldier with his present load cannot hope to rival that.

Also, when a flea bounds from one tactical objective to another, he sticks to the one strategical line. He does not shoot off at a tangent, haphazard fashion, from Champagne to Flanders, from Flanders to Belgium, Gallipoli, Salonika, Baghdad and Timbuctoo. No; unless forced by cruel circumstances or unhinged by mental and physical stress, *Pulex irritans* remains faithful to man, just as *Xenopsylla cheopis* clings to the rat, throughout the course of their respective lives.

There are known to be over 500 different kinds of fleas. Of these, about 46 are found in Britain; 26 on rats and mice; and of these 26 species, 5 are capable of carrying plague. A sixth, Xenopsylla, the great plague carrier of the Orient, does not like our climate. Nevertheless, he may come ashore at our ports at any time and bring plague with him.

So long as the drastic destruction of rats is neglected India will continue to suffer acutely from great epidemics of plague, and this country will emain liable to importation of that fell disease.

Besides, the rat is guilty of an enormous amount of economic damage; the employees of our hutted regimental institutes will testify to that.

In teaching us a useful lesson in the art of bounding, the flea has fulfilled his mission in life. Along with his host he may now be hissed off the stage. Therefore, I beg you to direct your attention to National Anti-rat Week.

This annual festival was founded by the Ministry of Health. It has extended its benefits in every direction and we are given the chance of participating. We do not take it seriously enough; we are too apt to regard it through the eyes of Mr. Punch—as a fit subject for good-humoured tolerance and jest.

That is wrong.

If we enter on National Anti-rat Week with earnestness and vigour, we shall accomplish one more prophylactic bound towards that great tactical objective, health.

VII.—The Attack.

There must be a good tactical plan, based on the best information obtainable. (F.S.R. II, 67, (1).)

I have talked about that supreme gift, the clinical sense.

However, before the plan of attack is decided upon, *every* piece of relevant diagnostic evidence must be brought up in support of clinical sense.

Where the clinical sense is weak, or absent, subsidiary diagnostic methods become the main sources of information.

To ignore these principles is to risk ambush: the ambush of symptoms. This is a risk which no honest, competent medical man will take. It is often taken by a certain type of "popular," incompetent practitioner, and knowingly too; but whereas the competency of the one is always discoverable, the incompetency of the other is often camouflaged by that charming bedside manner which deceives those who would know everything about their ailments—except the truth.

Beware of the man whose habitual plan of attack is directed against symptoms. If you are really intent on defeating your enemy, you do not reply to his fire by stuffing wool in your ears.

The best information is that which directs you to the root of the trouble.

The sound plan is that which encompasses the uprooting of the evil. This will eradicate the mischief while others, less well advised, are still lopping the branches.

It follows that *the attacking troops must be given definite objectives.* (F.S.R. II, 68 (1).)

With rare exceptions, the more simple a prescription is, the better it is. You will find that, as a rule, a prescription which contains a dozen or more ingredients will raise a smile; that is, if the author of the thing is not the doctor to whom you have shown it.

The sharpshooter's weapon is not the scatter-gun.

Success must be followed up until the enemy's power is crushed. (F.S.R. II. 79 (15).)

A medical officer often asks himself: "Does this person think I am a miracle worker?"

The question arises when a patient (not always an appropriate designation) who has been ill, say for six days, becomes tired of it, calls in his medical adviser, and then becomes fractious because he is not cured in six hours.

From the patient's point of view, duration of illness : duration of cure : : x days : x hours.

This may be human: obviously it is not reasonable.[1]

But then, even if you do defeat your enemy in six hours, the victory may—and probably will—cost losses which take six days to make good. In other words, cure does not necessarily connote an immediate return to health and strength; the initial success is followed by a period of convalescence during which the disease is followed up and finally crushed.

In the Service this is apt to be a difficult time for everybody. At one end the barrack-room houses the fit; at the other the hospital shelters the unfit. The medical inspection room is the bridge. The M.O. inscribes the morning sick report with such entries as "Discharged from hospital. To attend." He does not do this with a good grace for, although he is doing the best he can for the patient under the system, he is not doing the best that is possible. Also, he knows he is annoying the adjutant and irritating the serjeant-major.

In time of war this defect is blotted out by convalescent and advanced convalescent depots—institutions which are comparatively cheap and most efficient.

Should they not be given a place in peace establishments?

VIII.—The Defence.

The first essential is to decide on the general line in front of which it is intended to stop the enemy. (F.S.R. II, 91 (2).)

In organizing a defensive position the objects to be attained will be : . . . (iv) *The establishment of a network of defended localities which will contain a hostile penetration.* S.O.S. Tactical Exercise No. 4.)

Nature studied from the standpoint of medicine provides many, and striking, illustrations of these principles.

You all know about inoculations, but you do not know much about the disease for which "T.A.B." is the great prophylactic.

The germ of typhoid begins its attacks on the lining membrane of the lumen of the bowel, where it grows and multiplies, manufactures its poisons and damages its environment.

"The line in front of which" is the peritoneum; the membrane which

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[1] The Service M.O. is constantly up against this view. See a suggestive chapter entitled "Medical Attendance on Military Families" in Major M. B. H. Ritchie's book "Æsculapius Armaque." Therein the author says: "*Payment of a medical adviser is one of the psychological factors of effective treatment.*"

envelops the external surface of the bowel and lines the whole of the abdominal cavity.

Treatment is directed towards: (1) Supporting the general strength of the patient; maintaining *morale.* (2) Weakening the effects of the toxins; counteracting enemy propaganda. (3) Preventing penetration of the peritoneum; preventing rupture of "the line in front of which."

If treatment fails us the germs thrive, their positions become ulcers which destroy the defences, the peritoneum is broken, and widespread invasion of areas vital to the patient's life follows.

However, the network of defended localities may hold up the invading hosts; may even stabilize the penetration and afford time for the preparation of a counter-attack which, in turn, may change the whole aspect of the case.*

These localities are the lymphatic glands, and they are connected by a network of lymphatic vessels. You know them well; the painful armpit which follows vaccination, the swollen groin which follows a septic foot. They are wonderful strong-points; they have saved many a patient's life and many a doctor's reputation.

Any tendency to regard position warfare as the normal form of warfare must be repressed. (F.S.R. II, 98 (2).)

Those of us who served through the Great War will say "Amen" to that; but the doctor who is engaged in perpetual warfare of a harrowing and depressing description, must be forgiven a measure of scepticism. Even the optimist is doubtful, for the trump card may be in the enemy's hand. Too often the adversary imposes position warfare—and there is no escape.

Senility.

Monkey-gland?

No—let us succumb to senility.

Incurable disease.

Symptomatic treatment?

Yes, for uprooting is not possible. . . .

And yet, through it all Hope lives triumphant, for has it not been shown a hundred, a thousand, times that the incurable of to-day is the curable of to-morrow.

Nil desperandum—a splendid motto for soldier and doctor alike!

IX.—Retirement.

The retreats of great generals and of armies inured to war have always resembled the retreat of a wounded lion. (Clausewitz.)

With equal truth it may be said that the retreats of great doctors, and of modern therapeutics, resemble the retreat of a wounded lion.

Cholera is a disease in which the body tissues suffer from an extreme depletion of fluids. So violent and rapid is the attack, that the patient is

usually on the threshold of the other world before medical aid can be obtained.

There was a time—not so very long ago—when this medical aid was in the nature of a forlorn hope, but now, it is anything but that. An officer of the Indian Medical Service, Major (now Sir) Leonard Rogers, conceived the idea of injecting into the patients' veins some pints of strong salt solution. This, if carried out in the prescribed manner, lessens enormously the risk of a fatal issue.

By this procedure I have seen patients snatched from the jaws of death —speaking quite literally.

Another example from military medicine is that of blood transfusion by the "typed donor" method; one of the very few benefits which the Great War has conferred on mankind.

This measure is usually employed in cases of great loss or destruction of blood, and was of incalculable value in extensive shell wounds, etc., where shock was a factor.

It depends on the fact that, in human beings, there are found four different "types" of blood. The patient's blood type is first ascertained, and he then receives blood transfused from a volunteer donor, whose blood is of an appropriate type.

Here again, the patient who seems to be on the very brink of the grave will recover in the most astonishing manner.

So long as there is a spark of life left, a wounded lion may return to the charge at any moment.

* * * * *

"All very well" you say, "but what of the fashionable terrors of to-day?"

Well, it is true that we cannot see the sky for 'planes; we cannot hear our own voices for the roar of exhausts; we cannot taste or smell for the noxious products of chemistry.

All that remains to us is touch—and that is not enough.

Nevertheless, we need not despair.

When at work in a regimental aid post, and while wearing a gas mask, I have tried to stop the bleeding from a severed artery.

I failed.

It is unthinkable that chemists will be allowed to continue to release uncontrollable vapours which draw no distinction between friend and foe; which do not even single out the Red Cross of Geneva—except to bleach it white. The wordy protagonists of these methods are by no means the only people who are thinking about them.

The trouble at the present moment is lack of control. Why, even a mechanized force as often as not loses touch with its own commanding officer! Of what use to it is a M.O.? And as for the denizens of the air—so long as they remain content to kill, and be killed, without the slightest hope of earthly succour, so be it.

However, the day will come when gas, tanks and aeroplanes will not only be fashionable; they will be popular. The day of experiment will have been succeeded by that of experience, on which alone, sound practice can be based. It will then be found that these weapons have so altered, modified and developed their methods that they are able to do something which they cannot do now—to wage war in what we are pleased to call a "humane" fashion.

When that day arrives they will ask for medical aid, and the aid will be forthcoming for, in the past, Medicine has solved bigger and stranger problems than that.

APPENDIX.

Suggestions for Lessening the Soldier's Load.

		Save lb.	Save oz.
Abolish:—			
Steel helmet – a relic of the trenches		2	2
Pack, with supporting straps		1	11
Cap comforter			3¾
Lessen weights of:—			
Braces, 4¾ oz.			1¾
Knife, clasp, 7 oz.			2
Waistcoat, cardigan, 1 lb. 7 oz.			5
Bayonet, scabbard and frog, 1 lb. 12 oz.			8
Water-bottle, with carrier, 1 lb. 6 oz.			9
Web belt, braces with buckle, cartridge carriers and haversack, 4 lb. 8 oz.		1	2
Mess tin and cover, 1 lb. 4 oz.			6
Knife, fork and spoon			2½
Substitute:—			
For boots, ankle	Shoes	1	2
For cap, service dress, with badge	Beret		3
For drawers, woollen	Pants, woollen		9
For jackets, S.D., with titles and 1st fd. dress.	Blouse, serge		9
For puttees 1 pr., socks 2 prs.	Long stockings, to turn up or fold down, 2 pr.		7
For trousers, S.D.	Shorts		10
For sheet, ground	Poncho, waterproof, lined	(No change)	
For iron rations	Tea 1 oz., sugar 4 oz.	2	0
(N.B.—Load already includes cheese, 3 oz.)			
	Total saving	12	13
	Or, if box respirator is not carried, add	2	15
		15	12

Net result on load .. 42 lb. 9¾ oz.
or 37 lb. 10¾ oz.

N.B.—(1) Present load includes unconsumed ration—say, 12 oz. But even if this is NOT carried, the weight is certainly exceeded by private belongings carried in the pockets.

(2) Abolish the greatcoat, and carry an extra pair of shoes and other necessaries in the transport which was used for the greatcoat.

(3) Decrease of weight often means better quality and increase of cost, and perhaps—not always—shorter life. Hence, changes such as suggested would lead to strenuous opposition from the administrative (NOT including medical) side.

NOTES ON THE HISTORY OF THE MEDICAL STAFF CORPS AND ARMY HOSPITAL CORPS, 1854-1898.

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps.

(*Continued from p.* 361.)

The Nile Expeditionary Force, 1884-1885.[1]

The Suakin Force was withdrawn in the spring of 1884. As a result the Mahdi's troops under Osman Digna again dominated the Soudan. General Charles Gordon, the Egyptian Governor of the country, was isolated with one other British officer in Khartoum and there was grave anxiety for his future.

After delay on the part of the Government which proved fatal to success, Lord Wolseley was dispatched with orders to relieve Khartoum by the Nile route. The far shorter approach from the Red Sea by way of Berber was rejected on account of the waterless desert which would have to be crossed. Whale-boats were constructed capable of being dragged up the cataracts of the river, and the first detachment of troops embarked at Gemai, 870 miles from Khartoum, on November 5, 1884. The mounted troops, including a Camel Corps, proceeded up the banks. By December 25, with immense labour 2,200 men had reached Korti, and in a desperate attempt to reach the town Sir Herbert Stewart had started out from this point with 1,100 men and 2,200 camels across the desert. He was heavily attacked on January 17 at Abu Klea, losing seventy-four killed and ninety-four wounded. The enemy burst into the square and got among the wounded in the dressing station, many of whom were speared as they lay helpless on their stretchers. After further losses, including that of the General, the Nile was reached near El Gubat, from whence a handful of men reached Khartoum in one of Gordon's steamers two days after the town had fallen. After some fighting, the river column reached a point 350 miles from Khartoum when orders were received for its withdrawal.

During the advance up the Nile the Medical Staff Corps was distributed in a number of hospitals formed in grass huts at various points along the river. At Abu Fatmeh, the headquarters of the most advanced section of L. of C. was a 200-bedded field hospital under Surgeon Major L. Corban. The sick and wounded were sent down stream either in nuggars fitted with charpoys, or in whale-boats, being carried by hand or on cacolets where the river passage was impracticable After various stages, a railway was reached at Akasha, which took them to Wady Halfa, a point still 750 miles

[1] The medical history of this expedition is in A.M.D. Report, 1884.

from Cairo. Here there was a stationary hospital, whose staff included four nurses. The P.M.O. of the force was Deputy Surgeon-General John O'Nial, C.B.

The expeditionary force was in being from March 18, 1884, to July 31, 1885. In all some 11,000 troops were employed. Of the M.S.C., 54 men were absorbed by the bearer company, 43 by the movable field hospital, 7 were on convoy duty, and the remainder in 17 stationary field hospitals or rest posts; total, 392. There are said to have been five medical officers for every 1,000 men. Though the health of the troops, as judged by existing standards, was good, there were 760 cases of enteric and 277 deaths. Four of the surgeons died of this disease, and the deaths of seven men of the M.S.C. were recorded in the Abu Fatmeh section.

The medical personnel which accompanied the desert column were five medical officers and seventy-two other ranks. Describing the fighting near El Gubat, the author of "The War in Egypt and the Soudan" wrote: "The doctors showed splendid qualities of courage, endurance and professional experience. This was the fourth night that they had been without sleep, and they had been through two sharp fights and yet were at work until every wounded man had been attended. One fainted from exhaustion before he would give up. Surgeon McGill had distinguished himself by his work among the wounded until shot through the thigh. The bearer company also behaved with the utmost coolness. Every wounded man was at once picked up and placed on a cacolet, on a camel or upon a stretcher and removed."

The Suakin Expeditionary Force, 1885.

In February, 1885, Lord Wolseley urged the necessity for immediate action against the forces of Osman Digna from Suakin, and with this object, a force, including a brigade from India, was concentrated there towards the end of March. The medical arrangements made were extremely complete. The P. and O. ship "Ganges," provided a floating hospital of 200 beds, a hutted general base hospital for 300 beds with four nursing sisters was sent out from home, and a stationary field hospital, divisible into staging sections, for use on L. of C. There were four field hospitals on the new 100-bedded scale, and two bearer companies, one with cacolets, the other with wheeled transport. Five hundred dooley bearers with Lushai dandies were sent from India. The P.M.O. was Deputy Surgeon-General Oliver Barnet. The strength of the force was about 13,000.

Three of the field hospitals were attached to brigades, the Guards Brigade had also one of the two bearer companies, the other one, under Surgeon Major G. J. H. Evatt, co-operated with the cavalry. At the battle of Hashin on March 20, No. 1 Field Hospital, under Surgeon Major J. Shaw, did good service, one of its officers, Surgeon I. R. Lane, falling

mortally wounded at the head of his men. No. 2 Field Hospital, under Surgeon Major S. M. Fleming, was with the 2nd Brigade square at the same battle. On the 22nd a force under General MacNeil, which included half No. 2 Field Hospital, was attacked while forming its zariba near Tofrik. The enemy broke in, and hand to hand fighting ensued, in the course of which the Medical Staff Corps with their sword bayonets were at a great disadvantage, losing two killed and four wounded.

The force was withdrawn on May 17 after a campaign of seventy-five days. During the operations 203 of the Medical Staff Corps served in the hospital ships and base hospitals and 275 with the field units.

By this date the fighting dress of the soldier in hot climates had become more or less standardized. The British troops of the Indian contingent at Tel el Kebir in 1882 wore khaki drill with gaiters, those from home, undress serge. All had sun helmets. In 1884 the British troops from Egypt are described as wearing grey clothing. In 1885 both serge and khaki drill were provided; putties were worn by some of the troops in 1882.

Between November 27, 1885, and January 27, 1886, two brigades and a cavalry brigade with Egyptian troops operated from Wady Halfa on the Nile under Lieutenant-General Sir F. Stephenson. A 200-bedded hospital was established at Assouan, under Brigade Surgeon Markey, and a chain of small hospitals between that place and Kosheh. A mobile field hospital of fifty beds in charge of Surgeon Major H. J. W. Barrow accompanied the force. The enemy was routed on December 30 at the battle of Giniss, the bearer company taking part in the action and following up the pursuit. Their sick transport consisted of camels with litters and cacolets and riding camels.[1] Meanwhile, native troops were in frequent contact with the forces of Osman Digna in the Eastern Soudan. In the course of fighting, Colonel Herbert Kitchener, then Governor of the Red Sea littoral, was severely wounded in the jaw. A letter he wrote to Lord Wolseley in February, 1888, testified to the good treatment and nursing he received at the Citadel hospital at Cairo, and he described the hospital as "wonderfully well managed."

The Nile Frontier Force of 1889, for which a field hospital and a camel-bearer company were mobilized, with 14 medical officers and 105 M.S.C. drawn from Egypt, Malta and England, had a nearly bloodless campaign, as the forces of the Khalifa were dealt with by the Egyptian troops and a squadron of the 20th Hussars under General Wingate during the passage of the remaining British troops up the river. Surgeon J. J. C. Donnett was in action with the cavalry.[2]

The officers of the A.M.S. saw service in the Zhob Valley (1890), in Burma (1891-92), and in the Chitral Force (1895). In 1895-96 the expedition to Ashanti under Sir F. Scott took place. The British troops consisted of the 2nd West Yorks and a Special Service Corps made up of

[1] A.M.D. Report, 1885.

[2] A.M.D. Report, 1888.

drafts from various regiments at home. To these were added the 2nd West India Regiment and some Hausas. The men were carefully selected for service, all being over the age of 23. The P.M.O. was Surgeon-General W. Taylor, and there were twenty-four medical officers and eighty-five M.S.C. Kumasi was occupied without opposition on January 27, and there were no casualties in action. The length of marches in the 150 miles from Cape Coast Castle averaged ten miles a day. A high testimony was paid to the work of the medical orderlies, whose duties were very arduous.[1]

From March to October, 1896, a field hospital under Surgeon Major A. T .Sloggett, with two officers, a quartermaster and twenty-five other ranks M.S.C. were attached to the 1st Battalion N. Staffordshire Regiment, representing the British troops of the Dongola Expeditionary Force. There were no casualties in action, but the amount of sickness was great, including twenty-five cases of cholera and twenty-two deaths. One of the M.S.C. was among the victims, and another died from enteric fever. The same year cavalry and mounted infantry detachments co-operated with local forces in the suppression of risings in Matabeleland. Surgeon Lieutenant-Colonel J. A. Gormley with Surgeon Captains S. Hickson and N. C. Ferguson, and twenty of the M.S.C., served with this force, and a similar number of men under Surgeon Captain F. A. Saw were attached to a column operating in Mashonaland.

During these years there was considerable dissatisfaction among the medical officers at the conditions under which they served, due among other causes to the large amount of foreign service, the inadequacy of the Indian pay, and a general feeling that their status in the Army was unsatisfactory. In spite of various committees and inquiries no steps had been taken to carry out the recommendations of the Morley commission, and the abolition of " relative rank " by Royal Warrant in 1887 appeared a retrograde step. Candidates failed to present themselves for examination for commissions, and the service was banned by the medical schools. In January, 1891, a parliamentary paper was printed containing correspondence between Sir Andrew Clarke, President of the Royal College of Physicians, and the Secretary of State for War, setting out the main causes of complaint. The only immediate result was an improvement in the regulations for the grant of sick leave and the institution of composite titles for medical officers.

The announcement that the Army Medical Staff and the Medical Staff Corps were to be amalgamated into a Royal Corps was made by Lord Lansdowne at a banquet given at the Guildhall to the medical profession on May 4, 1898, and, as the Royal Army Medical Corps, they served under Sir Herbert Kitchener in the final stages of the Egyptian campaign that year.

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[1] A.M.D. Report, 1895.

THE NILE EXPEDITIONARY FORCE, 1898.

The campaign of 1898, resulting in the occupation of Khartoum and the restoration of Egyptian rule in the Soudan, lasted ten months. During the first period, terminating with the assault and capture of the Dervish position on the Atbara, one British and three Egyptian brigades were employed. Brigade Surgeon Lieutenant-Colonel W. H. Macnamara (P.M.O.) and thirteen officers formed the medical staff with the British troops. The advanced medical units consisted of a number of 25-bedded field hospitals, each calculated as one-sixth of a bearer company or one-quarter of a field hospital, an arrangement which proved much less satisfactory than a 100-bedded hospital divisible into sections. Five were allotted to an infantry brigade, and a proportionate number to other formations. There was, as usual, a difficulty about transport, and, as in 1882, the unfounded rumour that chloroform had to be left behind got started.

After a trying march, in the course of which most of the men's boots fell to pieces, the brigade joined up with the Egyptian troops on March 12, and, on April 8, the Dervishes were attacked at Neichla, after a heavy artillery bombardment, and routed. During the action the field hospital equipment was left with the reserve brigade about a mile from the firing line, while the M.O.'s and most of the personnel followed the troops in bearer company formation with stretchers and cacolets. Our casualties were 17 killed and 100 wounded.

After the battle there was rest for everyone except the doctors, and leave was freely granted. In July the British troops were increased by the arrival of a second infantry brigade and the 21st Lancers. Surgeon-General W. Taylor became P.M.O. of the force, Brigade Surgeon Lieutenaut-Colonel Macnamara the divisional P.M.O., and Lieutenant-Colonels A. T. Sloggett and G. A. Hughes, P.M.O.'s of brigades. The medical personnel, now R.A.M.C., were increased to about 60 officers and 139 other ranks. Lieutenant-Colonel T. J. Gallwey was P.M.O., Egyptian troops.

The advance began late in August, and on September 2 the battle of Omdurman was fought. The advanced dressing stations were sited immediately behind the firing line, and the main dressing stations only 200 yards further to the rear. The casualty list included the names of twenty-four killed and 138 wounded, to which the famous charge of the 21st Lancers contributed heavily. Lieutenant-Colonel Sloggett was shot through the chest and two other ranks R.A.M.C. were wounded. The subsequent evacuation of the wounded to the stationary hospitals at Atbara, Abadia, Wady Halfa, and Shellel, was comfortably carried out by means of specially fitted barges.

The conduct of the medical service in this campaign was not unrecognized. At a general parade at Cairo, General Sir F. Grenfell bore generous

testimony to the work of the Corps both in the hospitals and the field. Lord Kitchener said, "The general medical arrangements were all that could be desired, and I believe that the minimum of pain and the maximum of comfort procurable on active service in this country were attained by the unremitting energy, untiring zeal, and devotion to their duty by the entire medical staff." The honours included C.B.'s for the two senior officers, four D.S.O.'s and six brevets. Most satisfactory of all was the bestowal of the D.C.M. on six N.C.O.'s and men of the R.A.M.C.

During this and the preceding year officers of the Army Medical Staff took part in the operations at Sierra Leone and on the North-West Frontier.

One other event of the year must be referred to, in which the newly-formed Corps played a prominent and highly creditable part. The share of the R.M.L.I. and the infantry battalion in garrison in the Moslem outbreak at Candia on September 6 has been graphically described by Colonel Drury in "The Shadow on the Quarterdeck," that of the R.A.M.C. in the A.M.D. Report for 1898, under the modest heading, "Sanitary Conditions in Crete." It will be remembered that the trouble started with an attempt to collect an unpopular tax from an excited population with an inadequate display of military force. As a result, the garrison of some 400 men was for several hours on the defensive in an extremely precarious position with their backs to the sea.

The Greek hospital, which had been taken over, lay in an isolated and unprotected situation close to the town, some 800 yards from the nearest armed body of troops—a company of the Highland Light Infantry on the Canea bastion. In view of the popular feeling in the city the S.M.O., Lieutenant-Colonel M. R. Ryan, asked for the normal hospital guard of a sergeant and six men to be increased. On September 5, however, the guard was again cut down to normal, and, being still anxious for the protection of his patients, he obtained permission to draw rifles and ammunition with which to arm the patients and orderlies. The precaution turned out to be fully justified, and in all probability averted an indiscriminate massacre of the sick and their attendants.

When the outbreak occurred the following day, the hospital was the first point of attack. The S.M.O. happened to be at headquarters, where the infantry were surprised playing football, and he soon had his hands full dealing with casualties. At the hospital the R.A.M.C. were brought in from their tents, the doors were barricaded, and Lieutenant Addams Williams, the senior of the two young medical officers in the building, took over command. His force consisted of the hospital guard, 41 more or less able-bodied patients, and 5 N.C.O.'s and 11 men R.A.M.C. The attack lasted four hours, the assailants occupying the roofs and windows of the neighbouring buildings overlooking the defenders. In the evening the Turkish troops, who had up to then remained passive spectators, intervened, and the garrison was able to withdraw, having lost 3 H.L.I.

killed, 3 wounded, and 1 R.A.M.C., Private Biddiscombe, severely wounded. Most of the casualties occurred during a plucky and successful sortie led by Lieutenant Clarke, R.A.M.C., to bring in a private soldier who had been shot on his way to report sick. The other members of the party were an A.S.C. serjeant, five infantrymen, and Privates Philemon, Lowden, Leggatt and Biddiscombe, R.A.M.C. Lieutenant Clarke was slightly wounded.

DIRECTOR-GENERALS, 1853-1898.

Andrew Smith	1853
Thomas Alexander	1858
James Brown Gibson	1860
Thomas Galbraith Logan	1867
William Mure Muir	1874
Thomas Crawford	1882
William Alexander Mackinnon	1889
James Jameson	1896

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RANDOM JOTTINGS ON THE TRAINING OF THE R.A.M.C.

By Lieutenant-Colonel G. A. K. H. REED.
Royal Army Medical Corps.

II.—"Drill."

"Drill" as an end in itself died many years ago, but "drill" as a means to an end flourishes in every army. It is "drill" and its resultant attributes which make an army superior to an armed mob.

The modern tendency is to return to more elaborate and rigid drill for preliminary training purposes, in contradistinction to the somewhat free-and-easy methods in force immediately after the South African war, for there is no doubt that when really "up against it" the best drilled and so best trained unit comes out on top.

To a technical corps such as the R.A.M.C., "drill" *per se* is of course not so important as it is to combatant formations, at any rate in peace time, but nevertheless it is necessary, and what is worth doing at all is worth doing well. It is with the idea of arousing interest in drill as a means of training to greater efficiency that these remarks have been penned.

The points touched upon are of course known to and realized by all of us. Too often the weekly drill parade of a hospital company is looked upon as a fatigue by those highly trained in technical subjects. It is often carried through perfunctorily and with lack of attention to detail and correctness, with the result that little or no benefit is derived from it. This need not be, and I shall endeavour to indicate that the benefits of correct drill are more than counterbalanced by the little extra trouble involved.

"Drill" may be divided into two classes: (1) Ceremonial drill, and (2) practical drill (gun drill, fire drill, stretcher drill, and the like). The object of these two types of drill are different—they should never be confused. The original basis of all is, however, ceremonial drill.

Ceremonial Drill (company drill in our case) is designed (*a*) to make a display (not often very important from our point of view); and (*b*) to inculcate steadiness, handiness, and a spirit of manly obedience and discipline (very necessary for every branch of the Service). On the other hand, stretcher drill is intended to train men in the best methods of handling casualties with reference to their injuries, of carrying them on stretchers and loading them into ambulance vehicles. Quickness and gentleness are the attributes necessary. Stretcher drill, gun drill and fire drill are therefore unsuitable for ceremonial purposes, as rigid drill is not advisable in these. Ceremonial drill, as applicable to the R.A.M.C., partly consists of "platoon" and company drill. In this connexion we are at once up against an anomaly. The word "platoon" is derived from a

French military term, which meant a firing unit. To call a body of R.A.M.C. a "platoon" is therefore incorrect. One suggests that the older term "section" be reintroduced and substituted for "platoon" in the drill book, etc.

This again brings us to the subject of the nomenclature of medical units in general. The field ambulance "company" is a fairly large unit consisting of an "A.D.S. party" and a "bearer party." As far as I know, these subdivisions have received no official name. I suggest that the company be divided into three sections: No. 1 section to consist of one officer, one N.C.O., and five stretcher squads; No. 2 section to consist of one officer, one N.C.O., and four stretcher squads; and No. 3 section (the A.D.S. party) to comprise the remainder of the unit, including wagon orderlies and horsed transport, both ambulance and for stores. This would make the company more elastic and easier to detail and manœuvre. Written orders would also be shorter: "Nos. 1 and 2 Sections 'A' Company," is more compact than "'A' Company (less A.D.S. party and transport)." The Headquarters is a still larger unit, and for purposes of manœuvre should be officially divided into at least two sections, and always march as such. Infantry on the march are often practised in "air-craft formations"—little blobs get off the road and march in an irregular pattern. A similar formation is necessary for a field ambulance in order to increase flexibility and ease of control.

The physical benefits derived from ceremonial drill need not be touched upon; bodily co-ordination and control are the chief. It has also a highly beneficial effect on that elusive quality known as *morale*, as was realized during the war, when this form of drill was used extensively to "pull together" the remains of units which had suffered heavily in action.

Apart from this, ceremonial drill *properly carried out* makes a unit steady and handy, shortens the time taken to deploy, and makes such manœuvres as entraining, embarking, and getting in and out of billets easier for all concerned, by cultivating subconsciously readiness and alertness, and prompt obedience.

To gain the full benefits from ceremonial drill it must not be hurried, each movement, however small, must be led up to by an expectant pause, and succeeded by a pause. One movement must not be run into another, as this leads to unfinished drill and unsteadiness. The instructor must remember that a hurried stream of orders results in restlessness and often in inattention. Allowance must be made for the varying latent period of the men in the ranks. It goes without saying that restlessness or uncertainty on the part of the instructor is at once followed by unsteadiness and bad drill. His voice should be resolute and inspiring, not diffident, and certainly not a "snarl." Each movement must be finished and accurate. A few movements carried out correctly and with a "snap" and finish are far more beneficial than the whole gamut hurried through. Watch His Majesty's Guards on parade! A drawn-out caution like a

clarion, a tense pause, not a movement anywhere; every ear strained to hear the next order! Then an executive command, sharp, short and compelling. Crash! Another long pause, and so on—that is drill as it ought to be done!

We cannot hope to compete with such perfection—time and technicalities prevent—but at any rate we can improve and so gain some of the benefits. A pause of four beats should always be made between a "caution" and an "executive" command, with the possible exception of "Form Fours" and "Quick March," which should usually be given in the cadence of the movement required, i.e., at a beat of 120 to the minute. Above all, an instructor should never "nag;" "Not very good, try it again, that's better," is quite enough as a rule to stiffen things up.

While on the subject of ceremonial drill, one would advance a plea for the reintroduction of the side-arm for "other ranks" of the Corps. It improved the men's turn-out on ceremonial parades and guard mounting, fostered the military spirit and gave importance to a sentry who is nowadays often "armed" only with a stick or cudgel (the latter too often of the "H. Lauder" pattern!).

Apart from this, it is sometimes *necessary* for our Corps to be armed, and such is expressly permitted by the Geneva Convention, provided that the arms are only used "for the protection of the unit and that of the sick and wounded under its care." One has heard several tales of stretcher-bearers being held up by half-armed marauders, and I have myself seen a stretcher party fired on by Arabs and one man wounded—the Red Cross brassard meant nothing to them; fortunately the rifle of an R.A.S.C. H.T. driver was handy and had the desired effect. When brought to book and handed over to the A.P.M., one delinquent was found to be a notorious murderer and bandit who was badly wanted. I understand he was afterwards hanged! An incident such as this puts a soldier in an undignified position if arms do not happen to be available, whether he is a combatant or not. An officer of the Corps riding up to an advanced post after an action was suddenly confronted by two armed Turks who had been overlooked in the mop up; after some conversation between the Turks, the muzzle of a ·45 revolver helped them in their original intention, which no doubt was to surrender. They might have easily escaped as the country was broken, and as they were in rags and the officer was adequately clothed and had a useful horse, something else might have happened had the officer been unarmed!

During a "general" or other inspection of an R.A.M.C. unit, all that can be done is to call the company to "attention"; that is the beginning and end of the "compliment." In the old days "swords" were drawn, "sloped" and "carried" and a better display was possible. As a rule the solitary bugler is so out of practice (I do not, of course, allude to the Depot) that he is better left to his ordinary duty of answering the telephone, as the "general salute" call to be properly rendered requires practice.

To return to our "muttons," i.e., ceremonial drill: The ceremonial type of drill which we are required to know is very simple, and consists of movement from "close column" or "column" of "platoons" into column of fours, and vice versa, coupled with the few evolutions necessary for "marching past." Yet how many of us could take a company through these evolutions correctly and with finish, although it requires very little practice?

During the great mobilization in 1914, the same scene was enacted almost daily on the depot parade ground. A unit would be paraded and taken over by its commanding officer preparatory to entraining. The unit having been inspected, its new C.O. would then walk out to the front somewhat uncertainly, and then *sotto voce,* "You might tell me the proper words of command to get 'em down to the station, will you?" Not a good start! and yet the necessary words could be learnt in five minutes. I now tread on delicate ground, but suggest with all diffidence that a week at our Depot to wind up the "Majors' Course" would be popular and help to get over the effects of much indoor study.

Follow the unit mentioned above to the station—the train comes in, excitement and rushing about ensue with their attendant delay instead of a quiet and calm. Tell off loading parties—tell off the guard. Form fours. From the right—two ranks to a compartment. Entrain! To a unit with the drill habit (even if inexperienced) such things as these are simple and not much practice is necessary. The steadiness and alertness fostered by correct drill is an asset which means a great deal, not only "on service," but in the more efficient carrying out of any duties, even those of a highly technical nature; it fosters attention and concentration and shortens the latent period.

Perhaps it is asking too much nowadays, but one would like to see certain "semi-military" events reintroduced into our Annual Sports. "Reveille" and "First Aid" inter-company competitions used to be popular items, and fostered keenness and a spirit of rivalry which was all to the good.

A considerable time is spent at our annual field ambulance training camps in rubbing up drill which should be known already, and thus wasting time which is all too short for the advanced training necessary, but until the drill is mastered it is useless to go on to field work and medical tactical schemes.

Stretcher Drill.—Stretcher drill is a "practical" drill and an "end" in itself; it is not a ceremonial drill, and should not be used to inculcate steadiness and control. More free methods should be employed; each squad should perform its own task semi-independently; quickness and accuracy should be aimed at, though in training recruits a certain amount of "ceremonial method" must be introduced in order that the rudiments may be learnt.

In the present drill a great deal of time is wasted in sizing and telling off squads, and in redundant and unnecessarily complicated detail. I

understand this is being altered in a new form of drill now about to be introduced. Permanent squads should be formed and the men paraded in these squads. More time is thus available for the actual stretcher exercises. This is a great advance.

As has been mentioned, the aim and object of all drill is to train men in discipline, steadiness, mobility, and alertness (ceremonial), and quickness in a special piece of work (stretcher drill). These attributes are essential before training in field work can be undertaken with any hope of good results. In our Corps we have the drill, but little or no attempt has been made to apply it systematically to field work.

Field Formations.—It is true that extended order for stretcher squads is taught in order that ground may be searched, but as there is no adequate system of control and inter-communication taught, the results are not very satisfactory, and the training in field formations generally is rudimentary. Sundry schemes of training have appeared in these pages from time to time, but although they have been found to answer their purpose in actual warfare have been allowed to die out for want of official recognition.

A point which is often not realized is that under the conditions of mobile warfare it is not enough for the field ambulance bearers to clear the regimental aid posts—all the wounded will not be there—as, if an advance is rapid, the most the regimental stretcher bearers can do is to "group" casualties under cover and leave them there; if they attempt more they will often lose touch with their own units. Also, casualties are likely to be missed altogether, and if unable to move are likely to die from exposure or for want of first aid. It is, therefore, up to the field ambulance bearers to find the "groups" and isolated wounded, and to do this they must be able to deploy in a widely-extended formation, and beat up the ground covered by the troops in their advance as soon as conditions permit. Even before a systematic search can be made, a few suitably trained squads in extended formation can get in many casualties which might otherwise lie out for hours. If squads are properly trained in extended formation and use of ground, coupled with a knowledge of visual training and the "clock and finger" method of describing landmarks, the use of a few simple signals, etc., earlier evacuation from the R.A.P.'s is also possible. Without proper methods of control and training in the use of ground and landmarks, an extended line of stretcher squads soon loses direction if advancing over broken ground, and individual squads may be lost altogether.

Such methods of control are outlined in "Infantry Training," and with a little trouble can and have been modified to the requirements of stretcher bearers when searching ground. These should form part of our training, as has been proved by the experience of many of us in mobile warfare.

The field formations suggested for stretcher-bearers are two in number: (*a*) The present extended formation, but with a minimum interval for practical purposes of twenty paces between squads, and (*b*) a modification of this conveniently known as "second extension" in which the numbers

not engaged in carrying the closed stretcher form an extended line in front of the men actually carrying the stretcher or on each side of them. This second extension is useful when searching broken ground or at night, as lateral touch is easier. It is proposed to go into this matter more fully in a subsequent article.

All warfare is not of the semi-sedentary type, and experts tell us that the battles of the future will be highly mobile affairs over very wide frontages. Perhaps the day is not far off when mobile armoured aid posts and A.D.S.'s will follow the advancing line of tanks, evacuation being by special airplanes capable of rising steeply, with or against the wind, and so being independent of large landing grounds.

Whatever the future holds in store, the ultimate decision must rest with the foot soldier, who must be used to take, consolidate, and hold a position. His casualties must be searched for and collected by men on foot, even if based on an airplane or mobile armoured and gas-proof "aid post tank," so that very many years will have to pass before the fundamental methods of searching for and collecting wounded can be radically altered. The stretcher squad and the (often) hidden casualty will always be with us. Armistices for clearing a field of wounded are things of the past. War will become more and more ruthless, and its few "amenities" will disappear until it becomes so dreadful that the force of public opinion will cause it to cease altogether—but that day is not yet.

Editorial.

THE INTERNATIONAL CONGRESS.

Officers of the Corps will be particularly interested in the announcement that the fifth International Congress of Military Medicine and Pharmacy is to be held in London from May 6 to 11, 1929, and it may be anticipated that a large number of those now serving, and also retired officers, will avail themselves of this exceptional opportunity of meeting their colleagues who are working for the same ends in other countries, and of hearing their views on matters of special concern to the fighting forces.

As this is the first occasion on which England has been chosen as a meeting place, some of our readers may not be familiar with the history and objects of the Congress, and the following short account of its genesis and progress may be of interest.

During the war, with a view to affording the maximum benefit from the knowledge gained by each of the Allied countries in the treatment of wounds, inter-Allied surgical conferences were instituted and, as a result, a series of general rules for the treatment of all types of injury was formulated. The Belgian Army Medical Service, considering that this fruitful scientific collaboration should be continued in peace time, took the initiative of holding an International Congress of Military Medicine and Pharmacy, to which all allied and neutral nations were invited. This meeting was held in Brussels in 1921, under the patronage of the King of the Belgians, and twenty nations were represented. Two years later there was a congress at Rome, under the patronage of the King of Italy, attended by representatives of thirty-five nations.

The third Congress was held in Paris in 1925, under the patronage of the President of the French Republic, and forty nations were represented; while a fourth Congress took place at Warsaw, under the patronage of the President of Poland, in 1927, at which thirty-two nations were represented.

The holding of the fifth Congress in May, 1929, falls to Great Britain, and the King has been graciously pleased to give his patronage. Field-Marshal the Duke of Connaught, K.G., has consented to be Vice-Patron The meetings will be held in the Grand Hall of the British Medical Association, from May 6 to 11.

The Presidents of the Honorary Committee are the First Lord of the Admiralty, the Secretary of State for War, and the Secretary of State for Air, while the Prime Minister and all the other Ministers of State, and the Lord Mayor of London, have agreed to be Honorary Presidents. In addition, there are sixty honorary Vice-Presidents, representative of the Services, the House of Commons, and important schools of medicine and pharmacy, the St. John and St. Andrew's Ambulance Associations, and the British Red Cross Society.

An important Organizing Committee has been formed, presided over by Lieutenant-General Sir Matthew Fell, Director-General, Army Medical Services. The Secretary of the Congress is Major A. D. Stirling, the War Office, Whitehall, S.W.1.

The subjects to be discussed are :—

(1) Evacuation of sick and wounded by water and by air. The rôle of the medical services in combined operations. (Reporting countries, Great Britain and France.)

(2) Tropical fevers of short duration. (Reporting countries, Great Britain and the Netherlands.)

(3) Wounds of blood-vessels and their sequelæ. (Reporting countries, Great Britain and Belgium.)

(4) The physical and chemical analysis of the glass and rubber articles employed by the medical services. (Reporting countries, Great Britain and Spain.)

(5) The standard of dental and physical fitness in the various military services. (Reporting countries, Great Britain and Cuba.)

The Royal Army Medical Corps will be well represented in these discussions, and papers have been promised by Colonel G. de la Cour, O.B.E., and Lieutenant-Colonel W. P. MacArthur, D.S.O., O.B.E., while Colonel J. P. Helliwell, C.B.E., is contributing on the subject of dental and physical fitness.

In order to minimize the difficulties involved by the use of different languages, arrangements have been made to supply those attending the Congress with the texts of the opening papers, and with summaries translated into English, French, Italian and Spanish.

In connexion with the Congress an exhibition of medical equipment of the Services and of drugs, dressings, surgical instruments and appliances, etc., will be held; and visits will be made to naval, military and Royal Air Force stations, where demonstrations of the various activities will be given. A Ladies' Committee is being formed to accompany the wives and daughters of members of the Congress, and to conduct them to various places of interest in London.

All medical officers, dental surgeons and pharmacists belonging to, or having belonged to, the forces of all nations admitted to membership of the League of Nations are invited to the Congress, and also all officers belonging to organizations in association with the medical services. The subscription is fixed at 10s. for gentlemen and 7s. 6d. for ladies. This entitles the subscriber to the preliminary publications, including the opening papers and summaries, and to copies of the official reports, and to participation in the official excursions and receptions organized for the Congress. Officers who desire to receive the advance publications must notify the Secretary of their intention to be present as early as possible before January 1, 1929, and at the latest by February 1. The railway companies in Great Britain and Ireland have agreed to issue first and third class tickets, available from May 4 to 13, 1929, at the ordinary single fare and one-third for the double journey, for all those attending the Congress.

Cross-channel passages from Ostend, Calais, Boulogne, Dieppe and Havre will be available at reduced rates. A list of hotels which have agreed to reserve accommodation for members has been prepared.

Clinical and other Notes.

A CASE OF CIRRHOSIS OF THE LIVER.

By Major F. M. LIPSCOMB.
Royal Army Medical Corps.

A case of non-alcoholic atrophic cirrhosis of the liver in a European soldier, aged 25, is sufficiently uncommon to make it worth placing on record. The pathological findings in this particular example, though suggestive, do not enable the cause to be definitely decided, yet, as noted below, they throw doubt on certain theories of ætiology that have been put forward.

Summary of Case.—Serjt. B., aged 25, total service seven years; service in India six years; admitted to hospital December 10, 1927.

History.—Since March, 1925, six admissions to hospital for pyrexial attacks of short duration, diagnosed variously as influenza, clinical malaria, etc.

In August, 1925, he was admitted for "medium primary" syphilis; treatment was completed in March, 1926. The second Wassermann reaction was positive, all others were negative.

In January, 1926, he did not feel fit, and got short of breath on running, but slept well and was able to "carry on."

In September, 1927, he began to lose weight.

While in hospital about this time he had a severe attack of colic on the right side of the abdomen.

In November, 1927, he had a rigor, backache and slight fever, with a palpable spleen which soon subsided under treatment for malaria. Parasites were *not* found in the blood. At this time he had an attack of piles, and it was noticed that his abdomen was prominent for a soldier of his slight figure. However, nothing definitely abnormal could be detected.

On December 6 he himself noticed that his abdomen was swelling; at the same time he had frequency, but no difficulty, of micturition, and the amount of urine passed was very small. Later his feet, especially his left, began to swell. Albumin was present in the urine on December 9.

No history of indigestion, hæmatemesis or of symptoms suggestive of cardiac disease could be obtained. Inquiries in his battalion confirmed his statement that he was practically a teetotaller.

Condition on Admission.—December 10, 1927. Looked ill and more than his age—thin and sallow. Considerable amount of free fluid in the abdomen; veins on abdomen engorged. Œdema of feet, the left more than the right. No œdema of arms or face. Œdema of bases of both

lungs. Heart displaced upwards but not enlarged; pulmonary systolic murmur; sounds otherwise normal. Upper border of liver in fifth intercostal space. Free fluid made it impossible to palpate any swelling that might have been present in the abdomen. Urine: concentrated, no albumin, no deposit. Blood picture: normal. Blood smears: negative for malaria.

On December 11 the abdomen was tapped; the fluid withdrawn had the characters and gave the reactions of a transudate such as is found in cirrhosis of the liver. A guinea-pig was inoculated with it with a negative result. After tapping, neither spleen nor liver nor any abnormality could be felt. The blood gave a negative Wassermann reaction.

Progress was steadily downhill until death occurred in coma with Cheyne-Stokes respiration on February 11, 1928.

Before this happened the abdomen was tapped four times, the character of the fluid being the same on each occasion.

There was irregular pyrexia with, at one time, well-marked tertian periodicity; but exhaustive examinations of the blood showed no evidence of malaria, and rigorous antimalarial treatment, controlled by quinine absorption tests, had no effect.

A second Wassermann reaction, after a provocative dose of sulfarsenol, was negative.

Urea concentration tests showed no impairment of renal efficiency.

There were two attacks of colic on the right side of the abdomen associated with passage of clear mucus in the stools. Laboratory examination of the fæces was negative.

Summary of Autopsy and Histological Examination of the Tissues.

Macroscopically.	*Microscopically.*
Liver. — Atrophic, "hobnail" cirrhosis—weight, 36 oz.	Atrophic, multilobular cirrhosis with extensive fatty degeneration.
Cæcum.—Thickened and œdematous, mucous membrane healthy.	Marked infiltration of submucosa and muscular layers with small round cells; between these two layers aggregations of polymorphonuclear cells almost amounting to small abscesses.
Lungs.—Congested and œdematous at both bases.	Areas of broncho-pneumonia.
Spleen. — Moderately enlarged and somewhat tough.	General congestion with dark yellow pigment in the cells; no malaria parasites.

COMMENT.

It used to be generally held that multilobular cirrhosis of the liver in Europeans was due, if not to the effect of alcohol on the liver, at least to intemperance associated with alcoholism; but of late years this view has been modified [1]. The present case is another nail in the coffin of that idea.

Another theory that has been more or less accepted is that cirrhosis of the liver in the tropics is due to chronic malaria, but some authorities express doubt and others are not unanimous as to the type of cirrhotic degeneration [2], [3], [4]. In a recent article, recording research into the condition of the red blood-cells in tropical cirrhosis, Hughes and Shrivastava [5] discuss this view of the ætiology. They quote observations on a series of cases at the Mayo Hospital, Lahore. Evidence of malaria is: (1) That the sufferers all came from the Punjab and were presumably infected from childhood; (2) that the cases occurred among a class in which treatment for malaria is likely to be inefficient; and (3) that the patients gave a history of chronic malaria and had irregular bouts of fever.

Malaria parasites were not found in the blood of these patients, nor were they seen in sections of liver and spleen from similar cases. The evidence, therefore, as the authors agree, can hardly be considered conclusive.

In the case described above it seems fairly certain that the disease began with an undiagnosed infection in 1925; the patient then contracted syphilis and was treated with N.A.B. The progress of the condition is shown by the loss of weight, enlargement of the spleen and attack of piles in November, 1927.

The condition of the cæcum and the history of colicky pains in the right side of the abdomen point to a chronic infection in the area drained by the portal vein that may well have been the origin of toxins which started the trouble. And, though the cirrhosis was not of syphilitic type, syphilis and arsenic are not likely to have done much good to an already damaged liver.

It is clear that neither alcoholism nor malaria was the cause, and it is instructive to note how easily the early symptoms of cirrhosis of the liver may be mistaken for "clinical malaria."

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[4] MANSON BAHR. Manson's "Tropical Diseases," 56.
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NOTES ON AN UNUSUAL CASE OF FRACTURE DISLOCATION OF THE METATARSAL BONES OF THE BIG TOES.

By Major J. C. A. DOWSE, M.C.
Royal Army Medical Corps.

The notes on the following case seem worthy of record owing to the comparative rarity of the injury.

Mrs. W., aged 31, was admitted to hospital on January 8, 1928, with injuries to both feet.

History.—On January 7, 1928, she took part in a ladies' race at a local sports and ran in high-heeled shoes. Another participant in the race crossed her and in an attempt to avoid a crash Mrs. W. tried to pull up but fell over and felt a sharp pain in both her feet. When seen by me some hours after the injury both feet were swollen at the instep. There was a marked angle at the metatarsal phalangeal joints of both big toes, the toes pointing at right angles to the metatarsal bones. A definite deformity could be felt at the first metatarsal tarsal joint of both feet. The right was the worse of the two. The plantar arch of both feet appeared more pronounced than normal.

A provisional diagnosis of dislocation of the metatarsal bones of both big toes at the metatarsal tarsal joint was made and the patient sent for X-ray examination.

The X-ray examination partially confirmed the diagnosis, the report was as follows:—

Right foot.—Fracture through the articular surface of the base of the first metatarsal, comparable to a Bennett's type fracture in the hand, with dorsal dislocation of the metatarsal bone.

Left foot.—Fracture of the base of the first metatarsal with angulation due to plantar flexion of the distal fragment. The fracture is comminuted, implicating the joint surface, again as in Bennett's fracture. There is also a transverse fracture of the base of the third metatarsal in good position.

Both feet were put up in plaster of Paris, under a general anæsthetic. The reduction of the condition was easy but to maintain it in position was very difficult; eventually fixation was effected.

The plaster was removed in ten days and massage and movement started. Pain was almost entirely absent after the first week of massage.

The patient was able to walk a little in March, and when last seen early in July said she had no discomfort whatsoever and had started dancing again and did not feel any pain. The interesting points in the case were:—

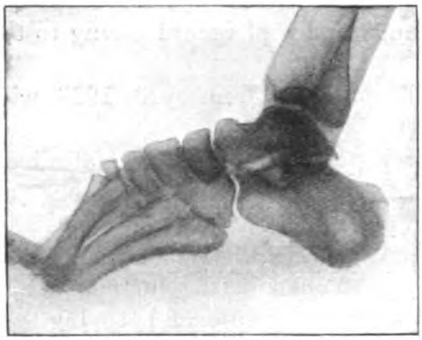
(i) The bilateral condition of almost similar injury.

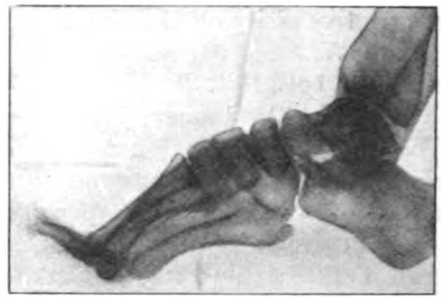
(ii) Such severe injury resulting from such slight trauma. It is left to the surgeons to work out the action of the forces involved and the resultant direction of those forces.

(iii) The remarkably good recovery in such a short time.

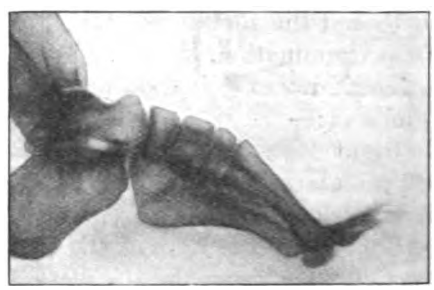
The X-ray pictures show the injury well, but in reduction the finer points were difficult to portray.

I am indebted to Major R. Boulton Myles, O.B.E., R.A.M.C., for the





Six months after injury.



Six months after injury.

X-ray prints, and to Major E. A. P. Brock, R.A.M.C., the Officer Commanding, Connaught Military Hospital, Poona, for permission to publish the case.

Prints of the X-ray photos taken at time of injury and six months afterwards are attached.

FASCIOLA HEPATICA: A FATAL CASE IN A EUROPEAN SOLDIER.

By Surgeon W. L. CHESTER, M.B., Medical Staff.

(*Reported by* Colonel F. SMITH, C.B., C.M.G., D.S.O.)

Liver fluke is such a rare affection in the British Army that I imagine this case, which I fished out of an old report, to be unique. Here is an abstract of the report.

The malady occurred in a 21-year-old soldier of the Dorsetshire Regiment. The boy arrived in Egypt from England in March, 1886.

On July 12 of the same year he was found unfit to proceed up the Nile with his battalion and was admitted to hospital.

He now came under the care of Surgeon W. L. Chester, Medical Staff, who ultimately wrote up the case.

At first suspected to have enteric fever the patient had high temperature, rapid pulse and respiration, brown tongue and slight bronchitis, liver and spleen enlarged.

August 9 was the first day on which pain in the liver was noticed, tenderness of that organ was extreme; nose picking sufficient to cause bleeding, sickly feeling leading to the man's trying to induce vomiting by putting his finger down his throat, anæmia, no rigors, finally hectic. Abscess of liver was suspected.

On August 29 the patiently suddenly collapsed and a few hours later died.

Post-mortem: Blood in the abdomen, no peritonitis. Liver weighed 5 pounds 13 ounces. A cavity the size of a hen's egg, in the base of the liver, had ruptured. In the liver were many cavities ranging in size from that of a hazel-nut to that of a hen's egg, the cavities seemed to be dilatations of bile-ducts with thickened walls, they contained bile and some of them also blood. Over a dozen live flukes were found and the examiner said: "Doubtless there were many more."

No entozoon found elsewhere. A pale and soft spleen weighed 13 ounces. The largest fluke measured 1 inch by ½ inch. It was flat, oval, rather pointed at the head, blunt and rounded posteriorly. At the tip of the head was a small orifice and about one-eighth of an inch from this in the middle line an elevated orifice which "appeared to contain a red clot of blood."

Case "doubtless, fasciola hepatica."

The diagnosis was the result of the post-mortem examination, and one wonders if cases of the same kind do not sometimes escape observation.

Rapidity of onset and shortness of course are noteworthy. The man had been barely four months in the country when admitted to hospital, and a little over six weeks after admission he was dead.

The case seems well worth republication.

Current Literature.

KRUMWIEDE, C., PARK, W. H., COOPER, G., GRUND, Marie, TYLER, C., and ROSENSTEIN, Carolyn. **The Purification of Contaminated Oysters in Natural Waters.** *Amer. J. Pub. Health.* 1928, v. 18, 48-52. [Bureau of Labs., Dept. of Health, New York, N.Y.]

A further series of experiments, mostly with oysters in natural waters. Lightly and heavily contaminated oysters were used and at temperatures high enough to ensure active drinking by the oysters. They were placed in natural waters, i.e., ensuring very great changes in the water from tidal flow. Under such conditions oysters native to the water cleared themselves of typhoid bacilli between the 11th and 24th days; oysters obtained from relatively distant waters between the 9th and 16th day. The original contamination with typhoid bacilli was obtained by causing them to drink in sea water containing fæces contaminated with this bacillus. Another experiment with sea water showed that *Bact. typhosum* may survive in sea water between 19 and 24 days.

From their experiments the authors conclude that oysters contaminated with *Bact. typhosum* when actively drinking in their natural habitat become non-infectious in three weeks. An ordinance allowing the transfer of oysters from doubtful waters to clean waters during the closed season, with the proviso that no dredging in the latter waters be allowed for a period of four weeks after the transfer, covers observed facts and gives a reasonably generous margin of safety.

W. G. SAVAGE.

Reprinted from "Bulletin of Hygiene," Vol. 3, No. 9.

FLINN, F. B., and INOUYE, J. M. **Metals in our Food.** *J. Amer. M. Ass.*, 1928, v. 90, 1010-13. [6 refs.]

The main part of the paper is taken up with a general discussion as to the possible effects of metals taken up from cooking utensils, such as iron, copper, tin, aluminium and nickel, upon health. The authors also carried out animal feeding experiments, mainly with rats, the animals being given considerable quantities of these metals and over long periods. Ten rats were used for each of the following metals: copper, tin, nickel, zinc and aluminium, the average daily dose being 2 mgm. of metal. They report that between 98·5 and 99 per cent. of the copper, tin and nickel is excreted in the fæces; 70 per cent. of the aluminium in the fæces and 30 per cent. in the urine; while zinc is equally divided between the two. There was practically no accumulation in the body.

Metal salts ingested with food combine with the proteins of the food

and are rendered harmless except when the metallic salt is present in excessive amount or perhaps in cases of hyperacidity. Ingested apart from food they are deleterious. [Details of these experiments are not given.] The authors' general opinion is that there is no evidence of chronic poisoning from metallic utensils and they particularly express this view as regards aluminium cooking vessels.

W. G. SAVAGE.

Reprinted from "Bulletin of Hygiene," Vol. 3, No. 9.

GLASGOW, CORPORATION OF. **Housing Department. Review of Operations, from 1919 to 1927.** 23 pp. Numerous plans and photographs. 1927. Glasgow.

Glasgow has an unenviable reputation for insanitary property. Its slums have become almost a byword throughout the Kingdom, but judging from the review of the work of its Housing Department from 1919-1927 the city is amply alive to its responsibilities and is making a very laudable effort to remove the reproach.

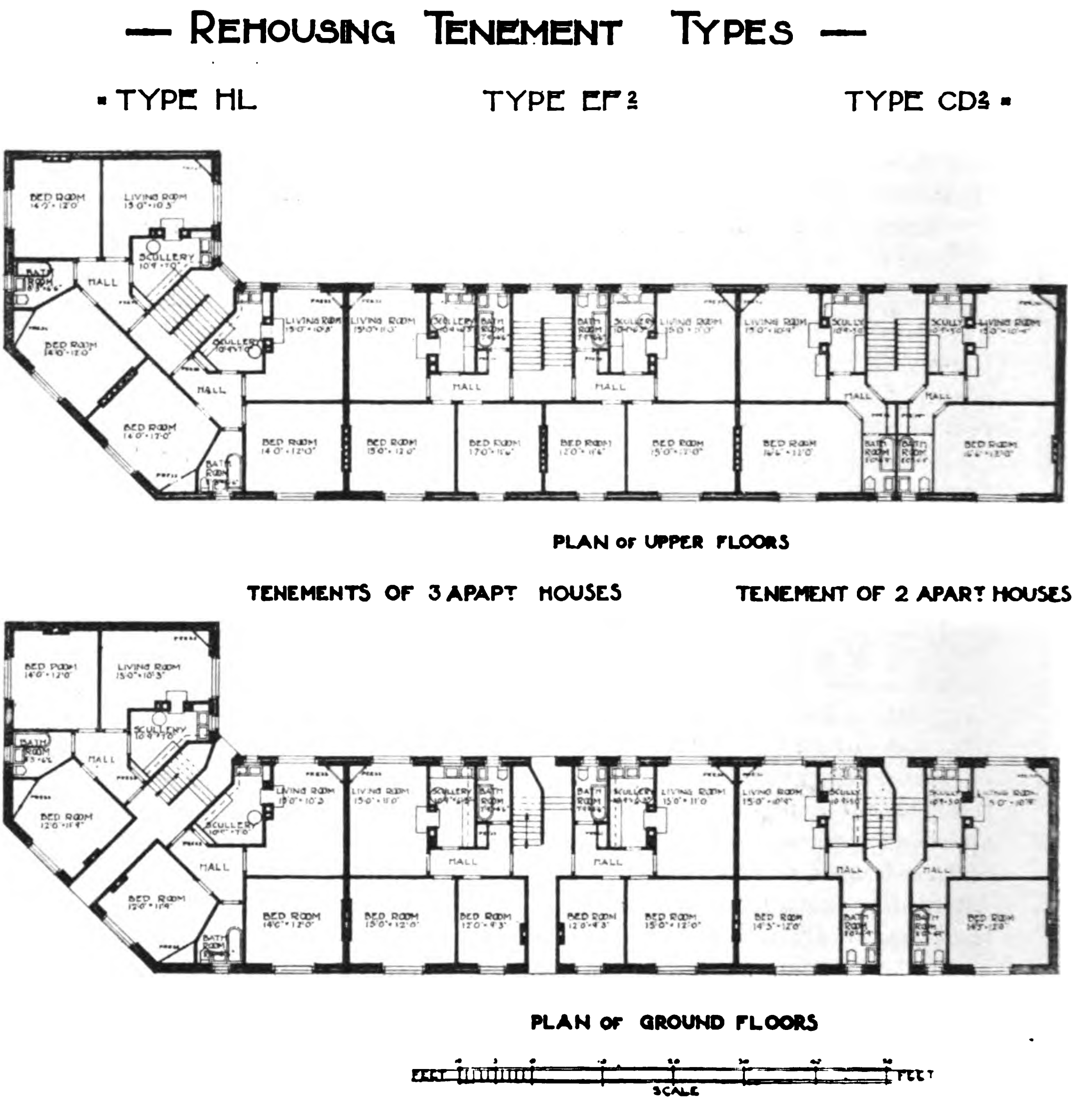
Since the passing of the Housing Act of 1919, no fewer than 16,473 new houses have been erected or are in course of construction in all parts of the city. The plans and photographs appended to the review give a very clear idea of the lay-out and the size and type of house adopted on the various estates. [A few of these are reproduced.]

But it is not only in the building of new houses that the Corporation has made progress, but also in respect of the clearance of slum areas which, from a health point of view, is the more important problem. Here the Corporation has shown a most commendable desire to make up for the time lost during the war years by tackling some of the largest and worst of of its insanitary areas. The Medical Officer of Health has estimated that some 12,000 houses in the city are uninhabitable. In 1923, the Corporation approved a recommendation of the Housing Committee to deal with some of these houses, and a scheme was prepared involving the demolition of 2,000. Alternative accommodation for dispossessed tenants was arranged for by the erection of 2 and 3-apartment houses on selected sites. The estimated cost of the scheme, including the acquisition and demolition of 2,000 slum houses and the erection af 2,000 new houses as alternative accommodation, was £750,000 and the annual deficit £20,000, of which the Government pays 50 per cent.

In 1926 and 1927 two other schemes were promoted, involving 2,052 houses at an estimated annual cost of two-fifths of a penny on the Health Rate.

In all, 4,000 houses will be dealt with in the three schemes mentioned, which is a fairly large bite out of the total scheduled by the Medical Officer of Health as requiring demolition.

In connexion with the housing schemes, arrangements have been made on certain of the estates for the formation of bowling and tennis clubs, the capital cost of greens and courts, with the necessary club houses in each case, being provided by the Corporation, the clubs paying interest on the



Plans of ground floors and upper floors of Tenement Houses, Types CD², EF² and HL, erected on the Hamilton Hill Re-housing Area by the Corporation of Glasgow.

[Reproduced from *Corporation of Glasgow Housing Dept. Review of Operations, from 1919 to 1927.*]

money outlaid and thus forming a sinking fund for the redemption of the debt. On all the larger estates suites of shops have been erected with the object of forming shopping centres readily accessible to the houses of

the people, whilst in each scheme sites have been reserved for public buildings, e.g., schools, churches, etc. On one estate a building has been erected for use as a social centre, with a hall to seat 200 persons, two commodious recreation rooms, platform retiring room, office for caretaker, and necessary kitchen, lavatories and storage accommodation. A verandah is built round the south, east and west sides of the building, overlooking an area which it is intended to use as a playground.

The houses are on the "living-room" principle, i.e., there are a living-room and two bedrooms in the three-apartment house, in the four-apartment house a living-room and three bedrooms, and in the five-apartment house, living-room, parlour and three bedrooms.

In 810 houses the fittings are all electric, i.e., the houses are lit by electricity, the kitchenettes are provided with electric cooker and electric wash-boiler; electric radiators are fitted in the bedroom, and there is a plug and switch for an electric iron in the kitchenette.

In the re-housing scheme for tenants from condemned areas about 59 per cent. are two-apartment houses and 41 per cent. three-apartment houses. All these houses are provided with bathrooms and kitchenettes, as in the ordinary schemes, but in place of an interior grate in the living-room and gas cooker in the kitchenette they have each a back-to-back fire in the living-room, with an oven in the kitchenette and gas grill and boiling ring over the same.

In the earlier schemes the buildings were of stone, but in the later years, owing to the excessive cost of stone, the walls have been built of either brick rough-cast or of concrete blocks.

The cost per three-apartment house in two-storey blocks containing four houses each, and exclusive of the cost of site, roads and sewers, ranged from £721 in 1919 to £895 in 1920, £507 in 1922 and £410 in 1927.

The rents for three-apartment flatted houses were from £26 10s. to £28 10s. per annum; four-apartment £31 and £32; three-apartment cottage houses £30 and £32; and four-apartment cottage houses £33 to £38. In the re-housing schemes there was a difficulty in fixing the rents, owing to the poor circumstances of the tenants, but they were ultimately decided as follows: two-apartment houses in three-storey tenements 28s. to 30s. per month, in two-storey blocks 33s. to 34s., three-apartment houses in three-storey tenements 32s. to 35s., and 36s. to 37s., in two-storey blocks 36s. to 38s. These figures include municipal, school and poor rates.

[The city has made a good beginning and, if it continues, Glasgow will not only succeed in eliminating its slums, but it will be one of the best arranged cities in the kingdom from the point of view of town planning. The review is well worth perusal by all interested in the housing problem].

J. Johnston Jervis.

Reprinted from "Bulletin of Hygiene," Vol. 3, No. 9.

Reviews.

SOME MORE MEDICAL VIEWS ON BIRTH CONTROL. Edited by Norman Haire, Ch.M., M.B. London: Cecil Palmer, 49, Chandos Street, W.C.2. Pp. 239. Price 7s. 6d. net.

I think the subject of birth control may resemble an Eastern city—interesting in distant perspective, and inclined to be unsavoury in too close detail. Here is a book which, on the whole, keeps well in the offing, though in parts the range has shortened. At any rate, one can give it credit for maintaining a distance more discreet than many of its fellows. It is published as an offset to Sir James Marchant's "Medical Views on Birth Control," and contains the opinions of eleven well-known advocates of control.

Dr. Haire opens the bowling. He is a rationalist and a hedonist, as defined by the Encyclopædia Britannica. He refers to the open abuse which the controllers and the uncontrollable hurl upon each other; he gives intimate details of his own family life, and the reader is inclined to wonder what the fraternal reactions on this book were like, and to hope that they were tempered by brotherly love. He writes a good article on his subject. Sir James Barr then bustles in and hits out right, left and centre. The bishops, the French Canadians, the League of Nations, the politicians and the Italians come in for some good hard knocks. And the "nations with small families brought the war to a happy issue."

Mr. A. W. Bourne comments on the "righteousness of contraception," and takes the reader through some murky byeways of methods. The controllers are fond of good phrases; Dr. F. A. E. Crew writes of the "regulation of fertility." He is not a militarist, a nationalist, nor an imperialist, and he regards the sex relationship as a "need, a source of legitimate pleasure, as the most basic, the most beautiful, of functionings." He is director of the Animal Breeding Research Department at Edinburgh University. The other contributors provide readable articles and make a good case for the controllers. There is, of course, a great deal to be said in favour of the Stopian school; equally, there is a great deal to be said against it. At any rate, the controllers state their views lucidly in this book, which is sure to be widely read in this labour-saving age. M. B. H. R.

AN INTRODUCTION TO PRACTICAL BACTERIOLOGY. By T. J. Mackie, M.D., D.P.H., and J. E. McCartney, M.D., D.Sc. Second edition. Edinburgh: E. and S. Livingstone. 1928. Pp. 390. Price 10s. 6d.

The fact that a second edition of this book has been found necessary within three years of the appearance of the first is an indication of the popularity which it has attained. There is no doubt that it fills a real

want, for it approaches the subject from an essentially practical point of view, and presents its matter in a very well balanced form.

It would be difficult to mention another book which is so free from "padding" as the one under review, yet within its 390 pages there is a perfect mine of information.

In scope and lay-out this edition is little different from its predecessor. It has, however, been brought right up to date, and certain sections, as the chapter on the cultivation of micro-organisms, have been considerably amplified. Eight chapters deal with the general aspect of the subject, and the remaining thirteen are devoted to descriptions of specific organisms or groups of organisms. These latter chapters are remarkably comprehensive when the size of the book is taken into consideration. Thus they deal not only with such organisms as cause disease in man, but also with many of the organisms which are pathogenic to domestic animals; nor are descriptions limited to bacteria, there being chapters on fungi, spirochætes, protozoa, and "filterable viruses."

A complete chapter in the early part of the book is devoted to the use of the microscope. This is to be welcomed. It is frequently said by manufacturers of optical instruments that their apparatus is rarely made to give its best results because those who use it are almost completely ignorant of the underlying principles. The indictment is usually made in reference to good cameras, but it applies almost equally to microscopes. The average medical man using a microscope seems to think only in terms of magnification, and has very little if any knowledge of the principles of illumination embodied in his instrument. Yet in more critical work, such as searching for protozoal cysts, correct illumination is the essence of success. In the chapter in question, the authors give much valuable information regarding the instrument as a whole, and it seems a pity that they have not gone a little more deeply into the question of illumination. Thus "critical illumination" is not defined, and the method described of attaining it relies to an unnecessary degree on factors which are not constant.

This volume has already received official blessing in being sanctioned for issue to laboratories as part of their library. But its small size and the profuse sound information which it contains should serve to recommend it as a book of reference to many who are not specialists in the subject.

TUBERCULOSIS: ITS PREVENTION AND HOME TREATMENT. By H. Hyslop Thomson, M.D., D.P.H. Third edition. 1928. Oxford University Press. Pp. xi + 99. Price 2s. 6d.

In this small volume the author has succeeded admirably in his aim of presenting a practical guide to the prevention and home treatment of tuberculosis, for the use of patients and those interested in the disease.

Written in simple language it contains nothing that the layman of average intelligence will not understand, and no fact the importance of which he will not appreciate.

Its eleven chapters are devoted to such matters as the causes of tuberculosis, how to avoid susceptibility, precautions against infection, personal measures, temperature and body weight, etc.

We consider that the volume should be in the hands of all suffering from tuberculosis, whether they have been in a sanatorium or are awaiting admission to one. It would be of enormous benefit to the community, too, if all parish sisters, health visitors and others who visit the poor in their homes were to study it, for they would be put in a position to be able to recognize many an early case of the disease, and to persuade the ignorant and careless to seek medical advice before it is too late.

G. F. D.

RATS AND HOW TO KILL THEM. By A. Moore Hogarth, F.E.S. London: John Bale, Sons & Danielsson, Ltd., 83-91, Great Titchfield Street, W.1. 1928. Pp. 45. Price 6d. net.

This interesting pamphlet should prove most useful to those interested in the organization of campaigns for rat destruction. The author first deals with diseases whose spread is attributed to the rat, and quotes figures showing the approximate annual cost of rats to the nation. The report on rat destruction by the U.S.A. Bureau of Agriculture is quoted at length, and many interesting remarks on American methods are noted. Under the heading "Removal of Shelter," it is stated "stored materials should be elevated 18 inches off the floor or ground." We have, however, always understood that at least 2½ feet is essential.

The section on poisons is clear and concise, and contains a Continental method which consists of making pancakes containing chopped *Scilla maritima*. Under processes of fumigation, the author mentions the use of exhaust gases from automobiles, tractors or other gasoline engines by attaching a tube to the engine exhaust. This sounds a most practical and simple method of fumigating burrows. The pamphlet concludes with the Rats and Mice (Destruction) Act, and a map showing the "March of the Rat."

G. D. J.

Correspondence.

"THE BREEDING OF ANOPHELES": A REPLY.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—It is of interest to note from the letter of Major R. A. Mansell, R.A.M.C., published in this month's Journal of the Royal Army Medical Corps, that further efforts are being made to elicit the life histories and other important details regarding the anopheline group in India, and it is hoped that the work now being carried out in all stations in the Lahore District will produce much valuable information.

Much has been written on the subject, but there does not, as yet, appear to be any concise information available for the average medical officer. One investigator may report on his finding regarding breeding places, another on the anatomy, etc., a third on the distribution of species in various localities, but no summary has, as far as I know, been published giving all these particulars in such a way as to be useful to all. The average medical officer has not the leisure nor inclination to sit down to read such textbooks as those of Patton and Cragg, Wenyon, Alcock, and other writers, yet he would have to do this if he wished to get a general idea of the subject.

I quite agree with Major Mansell that the dates given in my short article, published in the Journal of the Royal Army Medical Corps for May, 1928, are incomplete, but a beginning must be made somewhere, and dates can be altered as necessary; this has been done within two months of the appearance of my notes, and I hope further details will soon be forthcoming from other observers.

Adults of *Anopheles rossii* were found at Ferozepore in April, 1917, and in March, 1919, both earlier dates than that of May, 1928, given in Major Mansell's letter, and perhaps still earlier dates will be forthcoming before long. It is, however, impossible to say whether breeding throughout the year is carried on until more is known of the life histories and habits of these insects.

We are still in our infancy as regards our knowledge of many tropical diseases, malaria included, and it is hoped that all medical officers, both R.A.M.C. and I.M.S., will do all they can to advance our knowledge of a disease which is by far the most serious, when one considers wastage in man power, that we have to contend with in the tropics.

I remain, Sir,
Yours faithfully,
J. E. M. Boyd.
Major R.A.M.C.

Birchington-on-Sea, Kent.
October 13, 1928.

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C.L. = Current Literature.

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